ATTACHMENT 8
Benefits and Cost Analysis

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8 Attachment 8 – Benefits and Cost Analysis

Attachment 8 is mandatory. See Exhibit D for detailed guidance on the preparation of this attachment. There is no page limitation for Attachment 8; however, applicants are encouraged to be specific, clear, and concise.

Consistent with the IRWM Program 2012 Guidelines, all projects must yield multiple benefits to be eligible for grant funding. Describe and quantify (if applicable) the benefits and costs of each project in the proposal. The content provided in this attachment will be evaluated in a collective manner to see how all project benefits (combined) compare against the costs of all projects in the proposal.

This attachment allows applicants to claim monetized and non-monetized benefits based on the physical benefit descriptions as documented in Attachment 7. Individual project benefit analysis requirements vary as they depend on the type of project or benefit type. A process is provided in Figure 1 to guide applicants in selecting analysis methods. For the entire proposal, the applicant can submit the analysis performed with the method of analysis of their choice (termed "RWMG Method") or the "DWR Method" of analysis. If the DWR Method is chosen, there are four possible options for analyzing each project. Regardless of the methods or options chosen, a benefits and costs analysis must be completed for every project in the proposal. Whether the applicant chooses to use the DWR Method or the RWMG Method, the analysis will be evaluated and scored using the same scoring criterion.

8.1 Urban Bakersfield Water Use Efficiency Project

8.1.1 Summary

The proposed Urban Bakersfield Water Use Efficiency Project (UBAK or Project) will leverage and/or expand existing conservation incentive programs, municipal irrigation upgrades and education efforts. The UBAK program is a comprehensive and complimentary suite of water conservation efforts designed to address the key water uses in the City of Bakersfield (City) and assist the City and Improvement District No. 4 (ID4) in meeting their state regulatory requirements identified by SBX7-7 and AB 1420. The UBAK program includes a suite of elements that promote high-efficiency devices and best water conservation practices to improve indoor and outdoor water use efficiency of the City's residential, commercial and municipal customers through both specific efficiency projects and educational opportunities.

In addition to reducing potable demand, the UBAK program provides secondary benefits, which include a reduction in energy consumption and associated indirect greenhouse gas emissions, as well as a reduction in non-point source pollution.

The three program elements proposed will provide sustainable water savings, they include:

1. ***Municipal Irrigation Controller Program (UBAK1)***
2. ***Residential and Commercial Rebate Program (UBAK2)***
3. ***Education Program (UBAK3)***

Combined, these program elements target significant indoor and outdoor end uses of water in residential, commercial and municipal sectors and are estimated to achieve approximately 2,800 acre feet of water savings over the life of the resulting water conservation measures. Beyond the life of the measures, implementation of the Program will influence and transform markets and standards towards higher efficiency.

A summary of all benefits and costs of the project are provided in **Table 8.1-1**. Both monetized and non-monetized benefits are presented in this attachment, while physically quantified (but not monetized) benefits are described in Attachment 7.

Table 8.1-1: Benefit-Cost Analysis Overview

	Present Value
Costs – Total Capital and O&M	**$794,114**
Monetizable Benefits	
Avoided Water Supply Costs	**$1,281,796**
Total Monetizable Benefits	**$1,281,796**
Physically Quantified Benefit or Cost (Not Monetized)	**Project Life Total**
Reduced Wastewater discharge	30 AF
Reduced CO_2 Emissions	428 MT CO_2
Qualitative Benefit or Cost	**Qualitative Indicator***
Increased Social Recreation/Access Benefits	+
Increased Education	++
Helps Meet State Mandates for Water Conservation and Water Recycling	++
Improved Water Supply Reliability	+
Improve Water quality through reduced runoff	+

* Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
+ + = Likely to increase net benefits significantly.
– = Likely to decrease net benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or – .

MT = metric tons.
CO_2 = carbon dioxide.

8.1.2 Non-monetized Benefits Analysis (Section D2)

As discussed in Attachment 7 and Section D3 below, this project will result in water savings (the avoided project costs) that can be monetarily valued. However, the proposed project will also result in a number of benefits that cannot be easily quantified, but are also important. These benefits are qualitatively described in this section.

Table 8.1-2 shows the non-monetized benefits checklist for the project (using Table 12 from Exhibit C of the IRWM PSP). Narrative descriptions of the benefit categories marked “Yes” in the table are provided in the section following the table. It is important to note that this table is intended to only identify benefits of the project that cannot be monetized. Thus although a benefit might apply, a “No” is entered into the table if the benefit has been physically quantified and/or monetized.

Table 8.1-2: Non-monetized Benefits Checklist (Table 12)		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	Community/Social Benefits **Will the proposal**	
1	**Provide education or technology benefits?**	Yes
	Examples are not limited to, but may include: - Include educational features that should result in water supply, water quality, or flood damage reduction benefits? - Develop, test, or document a new technology for water supply, water quality, or flood damage reduction management? - Provide some other education or technological benefit?	
2	**Provide social recreation or access benefits?**	Yes
	Examples are not limited to, but may include: - Provide new or improved outdoor recreation opportunities? - Provide more access to open space? - Provide some other recreation or public access benefit?	
3	**Help avoid, reduce or resolve various public water resources conflicts?**	Yes
	Examples are not limited to, but may include: - Provide more opportunities for public involvement in water management? - Help avoid or resolve an existing conflict as evidenced by recurring fines or litigation? - Help meet an existing state mandate (e.g., water quality, water conservation, flood control)?	
4	**Promote social health and safety?**	No
	Examples are not limited to, but may include: - Increase urban water supply reliability for fire-fighting and critical services following seismic events? - Reduce risk to life from dam failure or flooding? - Reduce exposure to water-related hazards?	
5	**Have other social benefits?**	No
	Examples are not limited to, but may include: - Redress or increase inequitable distribution of environmental burdens?	

Table 8.1-2: Non-monetized Benefits Checklist (Table 12)		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	- Have disproportionate beneficial or adverse effects on disadvantaged communities, Native Americans, or other distinct cultural groups?	
	Environmental Stewardship Benefits: **Will the proposal**	
6	**Benefit wildlife or habitat in ways that were not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Cause an increase in the amount or quality of terrestrial, aquatic, riparian or wetland habitat? - Contribute to an existing biological opinion or recovery plan for a listed special status species? - Preserve or restore designated critical habitat of a listed species? - Enhance wildlife protection or habitat?	
7	**Improve water quality in ways that were not quantified in Attachment 7?**	Yes
	Examples are not limited to, but may include: - Cause an improvement in water quality in an impaired water body or sensitive habitat? - Prevent water quality degradation? - Cause some other improvement in water quality?	
8	**Reduce net emissions in ways that were not quantified in Attachment 7?**	Yes
	Examples are not limited to, but may include: - Reduce net production of greenhouse gasses? - Reduce net emissions of other harmful chemicals into the air or water?	
9	**Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?**	No
	Sustainability Benefits: **Will the proposal**	
10	**Improve the overall, long-term management of California groundwater resources?**	No
	Examples are not limited to, but may include: - Reduce extraction of non-renewable groundwater? - Promote aquifer storage or recharge?	

Table 8.1-2: Non-monetized Benefits Checklist (Table 12)		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
11	**Reduce demand for net diversions for the regions from the Delta?**	No
12	**Provide a long-term solution in place of a short-term one?**	No
13	**Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?**	No
	Examples are not limited to, but may include: - Reduce net energy use on a permanent basis? - Increase renewable energy production? - Include new buildings or modify buildings to include certified LEED features? - Provide a net increase in recycling or reuse of materials? - Replace unsustainable land or water management practices with recognized sustainable practices?	
14	**Improve water supply reliability in ways not quantified in Attachment 7?**	Yes
	Examples are not limited to, but may include: - Provide a more flexible mix of water sources? - Reduce likelihood of catastrophic supply outages? - Reduce supply uncertainty? - Reduce supply variability?	
15	**Other (If the above listed categories do not apply, provide non-monetized benefit description)?**	no

8.1.3 Narrative Description of Qualitative Benefits

Descriptions of the non-monetized benefits marked "Yes" from the checklist in Table 8-2 are described below.

Provide education or technology benefits

UBAK3 will expand the regional education program to include high school students and increase the number of teacher workshops. UBAK3 targets both teachers and students in Grades 7- 12 where there are no current programs.

Provide social recreation or access benefits

By improving the irrigation efficiency of all local parks (UBAK1) the project will improve the aesthetics and enjoyment of these areas by reducing overwatering that can cause muddy spots and reduce runoff. By reducing waste, the project will also serve as a model of proper irrigation practices and government stewardship to local residents.

Help avoid, reduce or resolve various public water resources conflicts?

All of the projects—UBAK1, 2 and 3— will help the City and ID4 meet the existing SBX7-7 and AB1420 state mandates.

Improve water quality in ways that were not quantified in Attachment 7.

UBAK1 and the landscape-related efforts in UBAK2 improve water quality by reducing runoff. Runoff from landscaped areas can contain various contaminants, including nutrients from fertilizers, pesticides and trash, which reduce the quality of receiving waters.

Reduce net emissions in ways that were not quantified in Attachment 7?

Efficient clothes washers (UBAK2) will decrease hot water related energy consumption for these fixtures. The program targets Tier 3 clothes washers which are the most energy-efficient washers available.

Improve water supply reliability in ways not quantified in Attachment 7

The reliability of a water supply refers to its ability to meet water demands on a consistent basis, even in times of drought or other constraints on source water availability. Since the City receives almost 20 percent of its water directly from the SWP and also derives benefit from the regional groundwater recharge with SWP water, imported water reliability is critical to the City. As noted above, the reliability of imported SWP water is subject to a number of natural and human forces, ranging from increased population growth (and the accompanying increased demands) to drought and earthquakes, to environmental regulations and water rights determinations. Thus the proposed project will help address reliability issues in Kern County by increasing supply through conserved water.

8.1.4 Monetized Benefits Analysis (Section D3)

The only benefit that was monetized for the UBAK project was the avoided water savings.

The City water system supplies water to approximately 35 percent of the City of Bakersfield. The remaining 65 percent of residents with the City are supplied from other retail water companies including

Cal Water, East Niles Community Services District and Vaughn Mutual Water Company. Cal Water maintains and operates the City Water System under contract. Cal Water also supplies water to its own customers within the City and is currently the largest municipal water supplier within the City. Cal Water has a water rate of $658/AF while the City's is $396/AF based only on the volumetric portion of the respective rates.

For UBAK1 57% of the savings occurs in Cal Water's and 43% in the City's service areas. The annual value of saved water was weighted to reflect this ratio. The lifetime of the irrigation system is assumed to be 15 years.

For UBAK 2, the entire savings are within the City's service area and therefore the City's rate is used to calculate the value of saved water. The lifetime of the rebated devices range from 4 years (conservation kits) to 25 years (toilets).

The proposed project will reduce water consumption by 2,828 AF over the expected 25-year project life.

Based on the assumptions described above and an annual real discount rate of 6% (per IRWM PSP Guidelines), total present value benefits associated with the avoided purchase of this water amounts to about $1.28 million over the 25-year project life as presented in **Table 8.1-3**.

8.1.1 Project Economic Costs

Capital costs for the project total $836,690. Construction and implementation costs (including construction administration and contingency) account for $748,116 (about 89%) of total capital costs. Project administration, planning, design and environmental documentation account for the remainder of the capital budget and are detailed in Attachment 4 - Budget.

No Operations and Maintenance (O&M) costs are projected. In UBAK1 it is assumed that the ongoing maintenance of the system will not be greater than currently occurs therefore no additional resources will be required to perform O&M with the project. UBAK 2 will end as soon as the rebates are expended and therefore not require ongoing fees. Similarly, the curriculum development and teacher training in UBAK3 will be completed by the end of the 3 year project term with no ongoing O&M. The annual costs of the Project are presented in **Table 8.1-4**.

The costs for the projects have a high degree of confidence. Estimates for UBAK1 have been procured from local vendors for both the purchase of the irrigation controllers and equipment as well as their installation. For UBAK2, the rebate costs have been identified and Cal Water has agreed to administer the program for just over $4,000 per year which is included in the project cost as an annual administration cost for the one year of the program implementation.

Table 8.1-3: UBAK1 and UBAK2 Annual Benefit

Table 15 – Annual Benefit
(All benefits should be in 2012 dollars)
Project: Urban Bakersfield Water Use Efficiency Project

(a)	(b)	(c)	(d)		(e)		(f)	Unit $ Value [1]		(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	UBAK1	UBAK2	ToTal savings	Change Resulting from Project (e) – (d)	City of Bakersfield	Cal Water	Annual $ Value [2] (f) x (g)	Discount Factor [(1)]	Discounted Benefits [(1)] (h) x (i)
2014	Reduced Consumption	Acre-feet	0	35.6	69.8	105.4	105.4	$ 396.00	$ 658.00	$ 61,153.25	0.890	**$54,426.39**
2015	Reduced Consumption	Acre-feet	0	71.2	65.3	136.5	136.5	$ 396.00	$ 658.00	$ 92,875.19	0.284	**$26,376.55**
2016	Reduced Consumption	Acre-feet	0	142.4	65.1	207.5	207.5	$ 396.00	$ 658.00	$ 159,834.07	0.792	**$126,588.58**
2017	Reduced Consumption	Acre-feet	0	142.4	65.0	207.4	207.4	$ 396.00	$ 658.00	$ 159,779.69	0.747	**$119,355.43**
2018	Reduced Consumption	Acre-feet	0	142.4	64.9	207.3	207.3	$ 396.00	$ 658.00	$ 159,731.00	0.705	**$112,610.35**
2019	Reduced Consumption	Acre-feet	0	142.4	62.3	204.7	204.7	$ 396.00	$ 658.00	$ 158,720.73	0.665	**$105,549.29**
2020	Reduced Consumption	Acre-feet	0	142.4	62.3	204.7	204.7	$ 396.00	$ 658.00	$ 158,711.30	0.627	**$99,511.98**
2021	Reduced Consumption	Acre-feet	0	142.4	62.3	204.7	204.7	$ 396.00	$ 658.00	$ 158,702.25	0.592	**$93,951.73**
2022	Reduced Consumption	Acre-feet	0	142.4	62.2	204.6	204.6	$ 396.00	$ 658.00	$ 158,674.14	0.558	**$88,540.17**
2023	Reduced Consumption	Acre-feet	0	142.4	62.2	204.6	204.6	$ 396.00	$ 658.00	$ 158,667.85	0.527	**$83,617.96**
2024	Reduced Consumption	Acre-feet	0	142.4	1.1	143.5	143.5	$ 396.00	$ 658.00	$ 134,464.48	0.497	**$66,828.85**
2025	Reduced Consumption	Acre-feet	0	142.4	1.1	143.5	143.5	$ 396.00	$ 658.00	$ 134,458.69	0.469	**$63,061.13**
2026	Reduced Consumption	Acre-feet	0	142.4	1.0	143.4	143.4	$ 396.00	$ 658.00	$ 134,430.77	0.442	**$59,418.40**
2027	Reduced Consumption	Acre-feet	0	142.4	1.0	143.4	143.4	$ 396.00	$ 658.00	$ 134,428.47	0.417	**$56,056.67**
2028	Reduced Consumption	Acre-feet	0	142.4	1.0	143.4	143.4	$ 396.00	$ 658.00	$ 134,426.27	0.394	**$52,963.95**
2029	Reduced Consumption	Acre-feet	0	106.8	1.0	107.8	107.8	$ 396.00	$ 658.00	$ 100,914.32	0.371	**$37,439.21**
2030	Reduced Consumption	Acre-feet	0	71.2	1.0	72.2	72.2	$ 396.00	$ 658.00	$ 67,402.46	0.350	**$23,590.86**
2031	Reduced Consumption	Acre-feet	0	35.6	1.0	36.6	36.6	$ 396.00	$ 658.00	$ 33,890.67	0.331	**$11,217.81**
2032	Reduced Consumption	Acre-feet	0	0.0	1.0	1.0	1.0	$ 396.00	$ 658.00	$ 378.97	0.312	**$118.24**
2033	Reduced Consumption	Acre-feet	0	0.0	1.0	1.0	1.0	$ 396.00	$ 658.00	$ 377.17	0.294	**$110.89**
2034	Reduced Consumption	Acre-feet	0	0.0	0.9	0.9	0.9	$ 396.00	$ 658.00	$ 375.45	0.278	**$104.37**
2035	Reduced Consumption	Acre-feet	0	0.0	0.9	0.9	0.9	$ 396.00	$ 658.00	$ 373.79	0.262	**$97.93**
2036	Reduced Consumption	Acre-feet	0	0.0	0.9	0.9	0.9	$ 396.00	$ 658.00	$ 372.20	0.247	**$91.93**
2037	Reduced Consumption	Acre-feet	0	0.0	0.9	0.9	0.9	$ 396.00	$ 658.00	$ 370.67	0.233	**$86.37**
2038	Reduced Consumption	Acre-feet	0	0.0	0.9	0.9	0.9	$ 396.00	$ 658.00	$ 369.21	0.220	**$81.23**
										Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)		**$1,281,796.27**

Comments:
(1) *Cal Water accouts for 30% of total savings, or 57% of UBAK1*
(2) calculated as calwater rate*57% of UBAK1, with the balance of the savings at BAK rate

Table 8.1-4: UBAK1 and UBAK2 Annual Project Costs

Table 19 – Annual Costs of Project (All costs should be in 2012 Dollars) Project: Urban Bakersfield Water Use Efficiency Project										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2014	$278,897				$4,000			$282,897	1.000	**$282,897**
2015	$278,897							$278,897	0.943	**$263,000**
2016	$278,897							$278,897	0.890	**$248,218**
...									...	
...									...	
Last Year of Project Life								$4,000	delta	
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										$794,114
Comments:										

(1) If any, based on opportunity costs, sunk costs and associated costs
(2) The incremental change in O&M costs attributable to the project

8.1.2 Project Benefits and Cost Summary

As shown in **Table 8.1-4** above, the total present value benefits associated with the Urban Bakersfield Water Use Efficiency Project amount to $1,281,800 over the expected 25-year project life from the avoided cost of purchasing that supply alone.

The total present value cost of the project (including capital and O&M costs) is $794,114. The proposed project will therefore result in total present value net benefits of $487,686 or a benefit cost ratio of 1.6 to 1.

In addition to the monetized benefits and costs, the proposed project will also result in the following physically quantifiable and non-monetized benefits:

- Reduced CO_2 emissions from reduced outdoor demands.
- Social recreation benefits due to efficient irrigation, reduce runoff and improved aesthetics of public parks.
- Increased regional education programs and teacher training.
- Help meet state mandates associated with water conservation.
- Improved water quality due to reduced runoff from irrigation.
- Improved water supply reliability through locally generated conserved water.

- Reduced wastewater treatment costs from reduced indoor demands.

This analysis of costs and benefits is based on available data and some assumptions. As a result, there may be some omissions, uncertainties, and possible biases. In this analysis, the main uncertainties are associated with the estimated lifetimes and water savings from the Park's irrigation controller upgrade and efficient devices. These issues are listed in **Table 8.1-5**.

Table 8.1-5: Omissions, Biases, and Uncertainties, and Their Effect on the Project

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Water Savings Estimates	U	UBAK1: water savings estimates are based on manufacturer estimates and City staff experience and coordination with other City's with the same system. Landscape savings are typically difficult to predict because they assume an unknown level of inefficiency to start. UBAK2: water saving estimates are based on analysis developed by Cal Water and derived from California Urban Water Conservation Council (CUWCC) assumptions. The estimates for indoor fixtures (toilets, washing machines) tend to be more predictable than landscape savings estimates. . In addition, water rate increases can also impact water savings as customer behavior can change to reduce monthly water costs. costs
Device life	+	UBAK1: device life is based on manufacturer estimates and City staff experience. This may be conservative because as long as the controllers are maintained they should continue to function. UBAK2: is based on CUWCC assumptions. However, once the fixtures are no longer functioning they will in all likelihood be replaced by fixtures that are at least of equal efficiency.

*Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
U = Uncertain, could be + or – .

8.2 Tehachapi Regional Water Use Efficiency Project

8.2.1 Summary

The proposed Tehachapi Regional Water Use Efficiency Project (Project) will reduce demand in the Tehachapi-Cummings County Water District (TCCWD), Golden Hills CSD, Stallion Springs CSD, Bear Valley CSD and the City of Tehachapi service areas by about 2,775 AF or 109 AF/yr (**Table 8.2-1**) over the device life through the implementation of the following programs:

Low-income direct install toilet replacement and audit (TCCWD1)

Toilet rebate (TCCWD2)

The Project includes a suite of programs that provide quantifiable and sustainable water savings and promote high-efficiency devices and best water conservation practices to improve indoor water use efficiency of the residential and commercial customers in the project service area. In addition to reducing potable demand, the project has a number of secondary benefits which include a reduction in energy consumption and associated indirect greenhouse gas emissions. Also, the Low-income direct install toilet replacement and audit project (TCCWD1) will address the needs of the disadvantaged community of the City of Tehachapi.

A summary of all benefits and costs of the project are provided in ***Table 8.2-1***. Both monetized and non-monetized benefits are presented in this attachment, while physically quantified (but not monetized) benefits are described in Attachment 7.

Table 8.2-1: Benefit-Cost Analysis Overview

	Present Value
Costs – Total Capital and O&M	**$687,375**
Monetizable Benefits	
Avoided Water Supply Costs	**$856,199**
Total Monetizable Benefits	**$856,199**
Physically Quantified Benefit or Cost (Not Monetized)	**Project Life Total**
Reduced Wastewater discharge	2,775 AF
Reduced CO_2 Emissions	14,988 Metric Tons (MT) CO_2
Qualitative Benefit or Cost	**Qualitative Indicator***
Increased Social Recreation/Access Benefits	-
Increased Education	++
Helps Meet State Mandates for Water Conservation and Water Recycling	++
Improved Water Supply Reliability	+
Improve Water quality through reduced runoff	+

* Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
+ + = Likely to increase net benefits significantly.
– = Likely to decrease net benefits.

CO_2 = carbon dioxide.

8.2.2 Non-monetized Benefits Analysis (Section D2)

As discussed in Attachment 7 and Section D3 below, this project will result in water savings (the avoided project costs) that can be monetarily valued. However, the proposed project will also result in a number of benefits that cannot be easily quantified, but are also important. These benefits are qualitatively described in this section.

Table 8.2-2 shows the non-monetized benefits checklist for the project (using Table 12 from Exhibit C of the IRWM PSP). Narrative descriptions of the benefit categories marked “Yes” in the table are provided in the section following the table. It is important to note that this table is intended to only identify benefits of the project that cannot be monetized. Thus although a benefit might apply, a “No” is entered into the table if the benefit has been physically quantified and/or monetized.

Table 8.2-2: Non-Monetized Benefits

No.	Question	Enter "Yes", "No" or "Neg"
	Community/Social Benefits **Will the proposal**	
1	**Provide education or technology benefits?**	No
	Examples are not limited to, but may include: - Include educational features that should result in water supply, water quality, or flood damage reduction benefits? - Develop, test, or document a new technology for water supply, water quality, or flood damage reduction management? - Provide some other education or technological benefit?	
2	**Provide social recreation or access benefits?**	No
	Examples are not limited to, but may include: - Provide new or improved outdoor recreation opportunities? - Provide more access to open space? - Provide some other recreation or public access benefit?	
3	**Help avoid, reduce or resolve various public water resources conflicts?**	Yes
	Examples are not limited to, but may include: - Provide more opportunities for public involvement in water management? - Help avoid or resolve an existing conflict as evidenced by recurring fines or litigation? - Help meet an existing state mandate (e.g., water quality, water conservation, flood control)?	TCCWD 1 and 2 will help meet SBX7-7 and AB1420 requirements
4	**Promote social health and safety?**	No
	Examples are not limited to, but may include: - Increase urban water supply reliability for fire-fighting and critical services following seismic events? - Reduce risk to life from dam failure or flooding? - Reduce exposure to water-related hazards?	
5	**Have other social benefits?**	Yes
	Examples are not limited to, but may include: - Redress or increase inequitable distribution of environmental burdens?	TCCWD1 provides services to the City of

No.	Question	Enter "Yes", "No" or "Neg"
	- Have disproportionate beneficial or adverse effects on disadvantaged communities, Native Americans, or other distinct cultural groups?	Tehachapi's DAC. Upgrading the efficiency of these customers will help reduce their water bills
	Environmental Stewardship Benefits: **Will the proposal**	
6	**Benefit wildlife or habitat in ways that were not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Cause an increase in the amount or quality of terrestrial, aquatic, riparian or wetland habitat? - Contribute to an existing biological opinion or recovery plan for a listed special status species? - Preserve or restore designated critical habitat of a listed species? - Enhance wildlife protection or habitat?	
7	**Improve water quality in ways that were not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Cause an improvement in water quality in an impaired water body or sensitive habitat? - Prevent water quality degradation? - Cause some other improvement in water quality?	
8	**Reduce net emissions in ways that were not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Reduce net production of greenhouse gasses? - Reduce net emissions of other harmful chemicals into the air or water?	
9	**Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?**	No
	Sustainability Benefits: **Will the proposal**	
10	**Improve the overall, long-term management of California groundwater resources?**	No
	Examples are not limited to, but may include:	

No.	Question	Enter "Yes", "No" or "Neg"
	- Reduce extraction of non-renewable groundwater? - Promote aquifer storage or recharge?	
11	**Reduce demand for net diversions for the regions from the Delta?**	No
12	**Provide a long-term solution in place of a short-term one?**	No
13	**Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?**	No
	Examples are not limited to, but may include: - Reduce net energy use on a permanent basis? - Increase renewable energy production? - Include new buildings or modify buildings to include certified LEED features? - Provide a net increase in recycling or reuse of materials? - Replace unsustainable land or water management practices with recognized sustainable practices?	
14	**Improve water supply reliability in ways not quantified in Attachment 7?**	Yes
	Examples are not limited to, but may include: - Provide a more flexible mix of water sources? - Reduce likelihood of catastrophic supply outages? - Reduce supply uncertainty? - Reduce supply variability?	
15	**Other (If the above listed categories do not apply, provide non-monetized benefit description)?**	No

8.2.3 Narrative Description of Qualitative Benefits

Descriptions of the non-monetized benefits marked "Yes" from the checklist in Table 8-2 are described below.

Help avoid, reduce or resolve various public water resources conflicts?

All of the projects—TCCWD1 and TCCWD 2— will help meet the existing SBX7-7 and AB1420 state mandates of reducing statewide water demand 20 percent by 2020.

Have other social benefits?

The City of Tehachapi is classified as a disadvantaged community (DAC) and TCCWD1 provides services to this community. Low-income customers tend not to participate in traditional agency rebate projects due to both the burden of the initial capital outlay and the expense and/or difficulty of hiring a plumber to do the installation. TCCWD1 will address these issues through the proposed direct-install project. The corresponding reduction in the resident's water bill is also particularly significant for low-income customers given the relatively high costs of water associated with the pumping costs.

Improve water supply reliability in ways not quantified in Attachment 7

The reliability of a water supply refers to its ability to meet water demands on a consistent basis, even in times of drought or other constraints on source water availability. As noted above, the reliability of imported SWP water is subject to a number of natural and human forces, ranging from increased population growth (and the accompanying increased demands) to drought and earthquakes, to environmental regulations and water rights determinations. Thus the proposed project will help address reliability issues in Kern County by increasing supply through conserved water.

Neither the qualitative benefits or the water and energy savings and associated CO2 emissions reductions due to avoided use of imported water and pumping groundwater are expected to result in any potential adverse physical effects.

8.2.4 Monetized Benefits Analysis (Section D3)

The only benefit that was monetized for the TCCWD project was the avoided cost of water. The TCCWD is located in the Tehachapi Mountains, east of the Southern San Joaquin Valley and encompasses approximately 266,000 acres. The TCCWD provides imported water supplies (SWP) and water resource management, and flood protection in the region through several improvement districts in the Tehachapi Basin. TCCWD provides wholesale imported water supply's that is pumped up 3,000 feet from the Bakersfield area that is also used for direct delivery as well as groundwater recharge for conjunctive use by the following agencies:

- Bear Valley CSD,
- City of Tehachapi,
- Golden Hills CSD, and
- Stallion Springs CSD

Each agency also pumps groundwater to meet customer demands. Attachment 7 described the estimated savings from the TCCWD1 and TCCWD 2 programs. In order to monetize these estimated savings, the avoided cost of water is provided in the narrative that follows.

The service areas for the various retail water suppliers have different rate structures. **Table 8.2-3** reflects the rates used in this analysis. These rates represent the unit rates without the fixed charge to reflect the avoided or marginal cost of supply. Note that wide range in rates reflects both the costs of pumping imported water up to TCCWD as well as the geography of this mountainous region. Bear Valley CSD, for example, has significant elevation changes in its service area and a pumping cost of almost $1,000/AF for its highest elevation customers.

Table 8.2-3: Water Rates for Tehachapi Area Purveyors

Supplier	Rates in AF
Golden Hills CSD	$ 805.86
Bear Valley CSD	$ 1,368.00
SSCSD	$ 1,197.90
City of Tehachapi	$ 531.87
Average	**$ 975.91**

Annual Value of Saved Water:

- For TCCWD1 all of the savings are in the City of Tehachapi and the rate of $531.87 is applied.
- For TCCWD2 the rebates were assumed to be evenly distributed between the agencies and an average rate of $975.91 was applied to the calculation.

The proposed project will reduce water consumption by 2,775 AF of water over the expected 25-year project life as described in Attachment 7.

Based on the assumptions described above and an annual real discount rate of 6% (per IRWM PSP Guidelines), total present value benefits associated with the avoided purchase of this water amounts to about $856,199 over the 25-year project life as presented in **Table 8.2-4** (Table 15 from PSP).

8.2.1 Project Economic Costs

Capital costs for the project total $750,000. Construction and implementation costs (including construction administration) account for $657,320 (about 87%) of total capital costs. Project administration, planning, and program design account for the remainder of the capital budget. See Attachment 4 for the detailed breakdown.

No O&M costs are projected. In TCCWD it is assumed that the toilets are robust and require no ongoing maintenance; any incidental warranty expense will be the responsibility of the direct-install contractor or manufacturer. TCCWD2 will end as soon as the rebates are expended and therefore will have no ongoing expenses **Table 8.2-5** (Table 19 from PSP) has distributed the costs over the two years (2013 and 2014) it is expected that these programs will occur over. When the costs are discounted, the total present value of the discounted costs is $687,375.

The costs for the projects have a high degree of confidence. TCCWD1 estimates have been procured from local vendors for both the purchase of the toilets as well as their installation and related audits. For TCCWD2 the rebate costs have been identified.

Table 8.2-4: TCCWD1 and TCCWD2 Annual Benefits

Table 15 – Annual Benefit
(All benefits should be in 2012 dollars)
Project: Tehachapi Regional Water Use Efficiency Project

(a)	(b)	(c)	(d)	(e1)	(e2)	(f)	(g1)	(g2)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With TCCWD1 Project	With TCCWD2 Project	Change Resulting from Project (e) – (d)	Unit $ Value City of Tehachapi	Unit $ Value (1) Blended	Annual $ Value (f) x (g)	Discount Factor	Discounted Benefits (1) (h) x (i)
2014	Reduced consumption	Acre-Feet (AF)	0	52.7	16.3	69.0	531.87	$976	$43,910	0.890	**$39,080**
2015	Reduced consumption	Acre-Feet (AF)	0	52.7	16.3	69.0	531.87	$976	$43,910	0.840	**$36,868**
2016	Reduced consumption	Acre-Feet (AF)	0	92.7	31.1	123.8	531.87	$976	$79,684	0.792	**$63,118**
2017	Reduced consumption	Acre-Feet (AF)	0	92.7	31.1	123.8	531.87	$976	$79,684	0.747	**$59,545**
2018	Reduced consumption	Acre-Feet (AF)	0	92.7	31.1	123.8	531.87	$976	$79,684	0.705	**$56,174**
2019	Reduced consumption	Acre-Feet (AF)	0	90.8	31.1	121.9	531.87	$976	$78,652	0.665	**$52,308**
2020	Reduced consumption	Acre-Feet (AF)	0	89.0	31.1	120.1	531.87	$976	$77,695	0.627	**$48,747**
2021	Reduced consumption	Acre-Feet (AF)	0	87.2	31.1	118.3	531.87	$976	$76,738	0.592	**$45,421**
2022	Reduced consumption	Acre-Feet (AF)	0	85.4	31.1	116.5	531.87	$976	$75,780	0.558	**$42,315**
2023	Reduced consumption	Acre-Feet (AF)	0	83.6	31.1	114.7	531.87	$976	$74,823	0.527	**$39,416**
2024	Reduced consumption	Acre-Feet (AF)	0	82.9	30.6	113.5	531.87	$976	$73,949	0.497	**$36,751**
2025	Reduced consumption	Acre-Feet (AF)	0	82.7	30.5	113.2	531.87	$976	$73,778	0.469	**$34,590**
2026	Reduced consumption	Acre-Feet (AF)	0	82.5	30.5	113.0	531.87	$976	$73,607	0.442	**$32,556**
2027	Reduced consumption	Acre-Feet (AF)	0	82.3	30.4	112.7	531.87	$976	$73,435	0.417	**$30,622**
2028	Reduced consumption	Acre-Feet (AF)	0	82.1	30.3	112.4	531.87	$976	$73,264	0.394	**$28,866**
2029	Reduced consumption	Acre-Feet (AF)	0	81.9	30.3	112.2	531.87	$976	$73,092	0.371	**$27,117**
2030	Reduced consumption	Acre-Feet (AF)	0	81.7	30.2	111.9	531.87	$976	$72,921	0.350	**$25,522**
2031	Reduced consumption	Acre-Feet (AF)	0	81.5	30.1	111.6	531.87	$976	$72,749	0.331	**$24,080**
2032	Reduced consumption	Acre-Feet (AF)	0	81.3	30.1	111.4	531.87	$976	$72,578	0.312	**$22,644**
2033	Reduced consumption	Acre-Feet (AF)	0	81.1	30.0	111.1	531.87	$976	$72,407	0.294	**$21,288**
2034	Reduced consumption	Acre-Feet (AF)	0	80.9	29.9	110.8	531.87	$976	$72,235	0.278	**$20,081**
2035	Reduced consumption	Acre-Feet (AF)	0	80.7	29.9	110.6	531.87	$976	$72,064	0.262	**$18,881**
2036	Reduced consumption	Acre-Feet (AF)	0	80.5	29.8	110.3	531.87	$976	$71,892	0.247	**$17,757**
2037	Reduced consumption	Acre-Feet (AF)	0	80.3	29.7	110.0	531.87	$976	$71,721	0.233	**$16,711**
2038	Reduced consumption	Acre-Feet (AF)	0	80.1	29.7	109.8	531.87	$976	$71,549	0.220	**$15,741**
										Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)	**$856,199**
Comments:											
(1) blended rate for the participating agencies											

Table 8.2-5: TCCWD1 and TCCWD2 Annual Project Costs

Table 19 – Annual Costs of Project (All costs should be in 2012 Dollars) Project: Tehachapi Regional Water Use Efficiency Project										
	Initial Costs Grand Total Cost from Table 7 (row (i), column	Adjusted Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +…+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012								0	1.000	0
2013	375,000							375,000	0.943	353,625
2014	375,000							375,000	0.890	333,750
2015									0.840	
…									…	
…									…	
Last Year of Project Life									…	
Total Present Value of Discounted Costs (Sum of column (j)) Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries										687,375
Comments:										

(1) If any, based on opportunity costs, sunk costs and associated costs
(2) The incremental change in O&M costs attributable to the project

8.2.2 Project Benefits and Cost Summary

As shown in **Table 8.2-1** above, the total present value benefits associated with the Tehachapi Regional Water Use Efficiency Project totals to $856,199 over the expected 25-year project life from the avoided cost of purchasing that supply alone.

The total present value cost of the project (including capital and O&M costs) is $687,375. The proposed project will therefore result in total present value net benefits of $168,825 or a benefit cost ratio of 1.25 to 1.

In addition to the monetized benefits and costs, the proposed project will also result in the following physically quantifiable and non-monetized benefits:

- Reduced CO_2 emissions estimated at almost 15,000 MT.
- Assistance to Tehachapi's disadvantaged community.
- Help meet state mandates associated with water conservation.
- Improved water supply reliability through locally generated conserved water.

This analysis of costs and benefits is based on available data and some assumptions. As a result, there may be some omissions, uncertainties, and possible biases. In this analysis, the main uncertainties are associated with the estimated lifetimes and water savings efficient devices. These issues are listed in **Table 8.2-6**.

Table 8.2-6: Omissions, Biases, and Uncertainties, and Their Effect on the Project

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Water Savings Estimates	U	Water saving estimates are based on analysis derived from California Urban Water Conservation Council (CUWCC) assumptions. While these are standard and accepted assumptions they will depend to some degree on the conditions under which they are installed and used. In addition, rate increases can also impact water savings as customer behavior can change to reduce monthly water costs.
Device life	+	Device lifetimes are based on CUWCC assumptions. However, once the fixtures are no longer functioning they will in all likelihood be replaced by fixtures that are at least of equal efficiency.

*Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
U = Uncertain, could be + or – .

8.3 Snyder Well Intertie Pipeline for Irrigation and Nitrate Removal

8.3.1 Summary

The proposed Snyder Well project will consist of constructing an intertie pipeline that would allow nitrate rich groundwater to be pumped from the Snyder Well for crop and landscaping irrigation. The project effectively removes the Jacobson Junior High School athletic fields from the City's potable water system as it would be served off of the intertie pipeline that that can receive non-potable water from TCCWD's raw water distribution system or from the Snyder Well. The Snyder Well, which has elevated nitrates, would be used by TCCWD (through an agreement with the City) to provide irrigation water to TCCWD customers in lieu of water pumped from other ag wells.

In addition to reducing potable demand, the Snyder Well project provides the secondary benefit of removing nitrates from the aquifer. The nitrates removed from the aquifer would be beneficially used as a supplement to the landscaping and agricultural field nitrogen requirements. Additionally, providing TCCWD water (through Snyder Well) to the athletic fields will significantly decrease the cost of irrigating the school's athletic fields.

A summary of all benefits and costs of the project are provided in ***Table 8.3-1***. Both monetized and non-monetized benefits are presented in this attachment, while physically quantified (but not monetized) benefits are described in Attachment 7.

Table 8.3-1: Benefit-Cost Analysis Overview

	Present Value
Costs – Total Capital and O&M	**$629,042**
Monetizable Benefits	
Avoided Water Supply Costs	**$515,962**
Total Monetizable Benefits	**$515,962**
Physically Quantified Benefit or Cost (Not Monetized)	**Project Life Total**
Reduced City Potable Pumping Capacity	105 gpm
Nitrate Removal	1,100 lbs/yr
Qualitative Benefit or Cost	**Qualitative Indicator***
Improve water quality for disadvantaged communities and the watershed over the planning horizon	++
Maximize the use of lesser quality water for appropriate uses (landscaping, agricultural crops, "aesthetic" projects)	++
Optimize local management of water resources to improve water supply reliability	+ +
Continue to provide drinking water that meets or exceeds water quality standards; and support efforts to attain appropriate standards	+

* Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
+ + = Likely to increase net benefits significantly.
– = Likely to decrease net benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or – .

8.3.2 Non-monetized Benefits Analysis (Section D2)

As discussed in Attachment 7 and Section D3 below, this project will result in water savings (the avoided project costs) that can be monetarily valued. However, the proposed project will also result in a number of benefits that cannot be easily quantified, but are also important. These benefits are qualitatively described in this section.

Table 8.3-2 shows the non-monetized benefits checklist for the project (using Table 12 from Exhibit C of the IRWM PSP). Narrative descriptions of the benefit categories marked "Yes" in the table are provided in the section following the table. It is important to note that this table is intended to only identify benefits of the project that cannot be monetized. Thus although a benefit might apply, a "No" is entered into the table if the benefit has been physically quantified and/or monetized.

Table 8.3-2: Non-monetized Benefits Checklist

Table 12 – Non-monetized Benefits Checklist		
No	**Question**	**Enter "Yes", "No" or "Neg"**
	Community/Social Benefits **Will the proposal**	
1	**Provide education or technology benefits?**	Yes
	Examples are not limited to, but may include: - Include educational features that should result in water supply, water quality, or flood damage reduction benefits? - Develop, test, or document a new technology for water supply, water quality, or flood damage reduction management? - Provide some other education or technological benefit?	
2	**Provide social recreation or access benefits?**	Yes
	Examples are not limited to, but may include: - Provide new or improved outdoor recreation opportunities? - Provide more access to open space? - Provide some other recreation or public access benefit?	
3	**Help avoid, reduce or resolve various public water resources conflicts?**	Yes
	Examples are not limited to, but may include: - Provide more opportunities for public involvement in water management? - Help avoid or resolve an existing conflict as evidenced by recurring fines or litigation?	

Table 12 – Non-monetized Benefits Checklist		
No	**Question**	**Enter "Yes", "No" or "Neg"**
	- Help meet an existing state mandate (e.g., water quality, water conservation, flood control)?	
4	**Promote social health and safety?**	No
	Examples are not limited to, but may include: - Increase urban water supply reliability for fire-fighting and critical services following seismic events? - Reduce risk to life from dam failure or flooding? - Reduce exposure to water-related hazards?	
5	**Have other social benefits?**	Yes
	Examples are not limited to, but may include: - Redress or increase inequitable distribution of environmental burdens? - Have disproportionate beneficial or adverse effects on disadvantaged communities, Native Americans, or other distinct cultural groups?	
	Environmental Stewardship Benefits: **Will the proposal**	
6	**Benefit wildlife or habitat in ways that were not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Cause an increase in the amount or quality of terrestrial, aquatic, riparian or wetland habitat? - Contribute to an existing biological opinion or recovery plan for a listed special status species? - Preserve or restore designated critical habitat of a listed species? - Enhance wildlife protection or habitat?	
7	**Improve water quality in ways that were not quantified in Attachment 7?**	Yes
	Examples are not limited to, but may include: - Cause an improvement in water quality in an impaired water body or sensitive habitat?	

Table 12 – Non-monetized Benefits Checklist		
No	**Question**	**Enter "Yes", "No" or "Neg"**
	- Prevent water quality degradation? - Cause some other improvement in water quality?	
8	**Reduce net emissions in ways that were not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Reduce net production of greenhouse gasses? - Reduce net emissions of other harmful chemicals into the air or water?	
9	**Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?**	No
	Sustainability Benefits: **Will the proposal**	
10	**Improve the overall, long-term management of California groundwater resources?**	Yes
	Examples are not limited to, but may include: - Reduce extraction of non-renewable groundwater? - Promote aquifer storage or recharge?	
11	**Reduce demand for net diversions for the regions from the Delta?**	No
12	**Provide a long-term solution in place of a short-term one?**	No
13	**Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?**	No
	Examples are not limited to, but may include: - Reduce net energy use on a permanent basis? - Increase renewable energy production? - Include new buildings or modify buildings to include certified LEED features? - Provide a net increase in recycling or reuse of materials? - Replace unsustainable land or water management	

Table 12 – Non-monetized Benefits Checklist		
No	**Question**	**Enter "Yes", "No" or "Neg"**
	practices with recognized sustainable practices?	
14	**Improve water supply reliability in ways not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Provide a more flexible mix of water sources? - Reduce likelihood of catastrophic supply outages? - Reduce supply uncertainty? - Reduce supply variability?	
15	**Other (If the above listed categories do not apply, provide non-monetized benefit description)?**	No

8.3.3 Narrative Description of Qualitative Benefits

Descriptions of the non-monetized benefits marked "Yes" from the checklist in Table 8-2 are described below.

Provide education or technology benefits

The Snyder Well project includes a monitoring component that will improve information regarding the nitrate contamination in the Tehachapi Groundwater Basin. One goal for the monitoring of this project is to determine if there is a correlation between the amount of water pumped from the Snyder Well and the nitrate concentrations. This project makes an excellent pilot project to monitor the response of nitrates concentrations through pumping of the aquifer. This method of groundwater remediation is recommended in the recent UC Davis nitrate study as discussed in Attachment 7 - Technical Justification. By the close observation of this well, the agencies will be able to monitor the success of the project.

Provide social recreation or access benefits

The construction of the intertie pipeline will allow the irrigation of the Jacobson Junior High School athletic fields with lower cost TCCWD water. This will help ensure that the school's athletic fields remain a viable feature of the community without having to fallow large areas of turf grass.

Help avoid, reduce or resolve various public water resources conflicts?

The Project helps meet the Kern County IRWMP's goal of maximizing the use of lower quality waters for appropriate uses. The athletic fields will be removed from the City's potable water system and supplied with water from the Snyder Well, a City well that is unused due to nitrates that are above the State's MCL.

Have other social benefits?

The City of Tehachapi is a disadvantaged community with limited financial resources. The cost of irrigation the school's athletic field and the cost savings attributed to construction of the Project would benefit the area's residents. The significant reduction in school water costs will allow more money to become available for other needs in the school district including education programs that benefit the students.

Improve water quality in ways that were not quantified in Attachment 7

In addition to the nitrate removal quantified in Attachment 7, the Snyder Well groundwater will also be available for TCCWD to serve other customers including the High School athletic fields to the south of the Jr. High School. The use of nitrate contaminated groundwater on crops will further remove nitrates from the area's aquifer.

Improve the overall, long-term management of California groundwater resources?

The removal and beneficial use of nitrate contaminated groundwater from the aquifer has been cited as one of the most cost effective methods of nitrate removal. This project is an example of beneficially using a water source that is not fit for human consumption in a way that removes the contamination and helps provide healthy crops.

8.3.4 Monetized Benefits Analysis (Section D3)

As mentioned previously, the City of Tehachapi purchase SWP water from TCCWD through the conjunctive use program. This water that the City banks in the ground for later recovery is the marginal water supply that is used to meet their needs. Similar to the Tehachapi Regional Water Use Efficiency Project, by reducing the water demands on the City's water system, the lower the amount of marginal water supply is needed. Therefore, the approach for analyzing the monetized benefits associated with the proposed water demand reduction will be very similar to Section 8.2.4.

Based on the discussion of Benefit 1 in Attachment 7, the City will have an annual water supply demand reduction of 65 AFY. With this factor and the previously mentioned water cost of $532/AF for the City, the annual benefits table has been prepared as shown in **Table** 8.3-3.

A 50 year project life was selected based on the life of the proposed pipeline. The total present value benefit of the project is estimated at $515,962.

8.3.1 Project Economic Costs

Capital costs for the project total $626,321. Construction and implementation costs (including construction administration and contingency) account for $518,615 (about 83%) of total capital costs. Project administration, planning, easement document preparation, design and environmental documentation account for the remainder of the capital budget and are detailed in Attachment 4 - Budget.

The operation of the Project will have some minimal operation and maintenance (O&M) and administration costs associated (less than $5,000 per year). The annual costs associated with the Project are presented in **Table 8.3-4** (PSP Table 19). Additionally, the replacement of the Snyder Well was not factored into this analysis, because when the well reaches the end of its useful life (or fails), TCCWD still has the capability to serve the athletic fields.

The costs for the projects have a high degree of confidence as the design and construction is fairly straightforward. Estimates were obtained from AECOM for the design of the pipeline. The actual construction cost may vary somewhat depending on the bids received.

8.3.2 Project Benefits and Cost Summary

As shown in **Table 8.3-4**, the total present value benefits associated with the Snyder Well Intertie Pipeline Project amount to $515,962 over the expected 50-year project life from the avoided cost of purchasing conjunctive use water supplies from TCCWD.

The total present value cost of the project (including capital and O&M costs) is $629,042. This results in a negative net value. There are additional benefits both monetized and non-monetized, some of which are discussed in Attachment 7, that will increase the financial viability of the project. Some of these added benefits included:

- Reducing peak groundwater pumping demand.
- Reducing the water costs borne by TUSD.
- Nitrate removal from the groundwater and providing nitrate rich groundwater to landscaping and agricultural use thereby reducing the amount of commercial fertilizers required.
- Increased information gained about the correlation between groundwater pumping and nitrate concentration for the Region.
- Effective use of existing resources to meet the water needs of the area.

This task would require greater detail and additional cost to be borne by the City. The City is a Disadvantaged Community and has limited resources to fund extensive analyses. Therefore, based on these preliminary indications the project appears to be viable.

This analysis of costs and benefits is based on available data and some assumptions. As a result, there may be some omissions, uncertainties, and possible biases. In this analysis, the main uncertainties are associated with the estimated water demands of the athletic fields.

Table 8.3-3 Snyder Well Intertie Pipeline Project - Annual Benefit (PSP Table 15)

Table 15 – Annual Benefit
(All benefits should be in 2012 dollars)
Project: Snyder Well Intertie Pipeline Project

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value [1]	(h) Annual $ Value [2] (f) x (g)	(i) Discount Factor [1]	(j) Discounted Benefits [1] (h) x (i)
2014	Red. City Demand	AFY	2,024	1,959	65	$ 532	$ 34,580	0.890	$ 30,776
2015	Red. City Demand	AFY	2,040	1,975	65	$ 532	$ 34,580	0.840	$ 29,047
2016	Red. City Demand	AFY	2,032	1,967	65	$ 532	$ 34,580	0.792	$ 27,387
2017	Red. City Demand	AFY	2,025	1,960	65	$ 532	$ 34,580	0.747	$ 25,831
2018	Red. City Demand	AFY	2,017	1,952	65	$ 532	$ 34,580	0.705	$ 24,379
2019	Red. City Demand	AFY	2,010	1,945	65	$ 532	$ 34,580	0.665	$ 22,996
2020	Red. City Demand	AFY	2,002	1,937	65	$ 532	$ 34,580	0.627	$ 21,682
2021	Red. City Demand	AFY	2,444	2,379	65	$ 532	$ 34,580	0.592	$ 20,471
2022	Red. City Demand	AFY	2,886	2,821	65	$ 532	$ 34,580	0.558	$ 19,296
2023	Red. City Demand	AFY	3,329	3,264	65	$ 532	$ 34,580	0.527	$ 18,224
2024	Red. City Demand	AFY	3,771	3,706	65	$ 532	$ 34,580	0.497	$ 17,186
2025	Red. City Demand	AFY	2,211	2,146	65	$ 532	$ 34,580	0.469	$ 16,218
2026	Red. City Demand	AFY	2,257	2,192	65	$ 532	$ 34,580	0.442	$ 15,284
2027	Red. City Demand	AFY	2,303	2,238	65	$ 532	$ 34,580	0.417	$ 14,420
2028	Red. City Demand	AFY	2,349	2,284	65	$ 532	$ 34,580	0.394	$ 13,625
2029	Red. City Demand	AFY	2,395	2,330	65	$ 532	$ 34,580	0.371	$ 12,829
2030	Red. City Demand	AFY	2,441	2,376	65	$ 532	$ 34,580	0.350	$ 12,103
2031	Red. City Demand	AFY	2,492	2,427	65	$ 532	$ 34,580	0.331	$ 11,446
2032	Red. City Demand	AFY	2,543	2,478	65	$ 532	$ 34,580	0.312	$ 10,789
2033	Red. City Demand	AFY	2,593	2,528	65	$ 532	$ 34,580	0.294	$ 10,167
2034	Red. City Demand	AFY	2,644	2,579	65	$ 532	$ 34,580	0.278	$ 9,613
2035	Red. City Demand	AFY	2,695	2,630	65	$ 532	$ 34,580	0.262	$ 9,060
2036	Red. City Demand	AFY	2,751	2,686	65	$ 532	$ 34,580	0.247	$ 8,541
2037	Red. City Demand	AFY	2,807	2,742	65	$ 532	$ 34,580	0.233	$ 8,057
2038	Red. City Demand	AFY	2,863	2,798	65	$ 532	$ 34,580	0.220	$ 7,608
2039	Red. City Demand	AFY	2,919	2,854	65	$ 532	$ 34,580	0.207	$ 7,158
2040	Red. City Demand	AFY	2,975	2,910	65	$ 532	$ 34,580	0.196	$ 6,778
2041	Red. City Demand	AFY	3,031	2,966	65	$ 532	$ 34,580	0.185	$ 6,397
2042	Red. City Demand	AFY	3,087	3,022	65	$ 532	$ 34,580	0.174	$ 6,017
2043	Red. City Demand	AFY	3,143	3,078	65	$ 532	$ 34,580	0.164	$ 5,671
2044	Red. City Demand	AFY	3,199	3,134	65	$ 532	$ 34,580	0.155	$ 5,360
2045	Red. City Demand	AFY	3,255	3,190	65	$ 532	$ 34,580	0.146	$ 5,049
2046	Red. City Demand	AFY	3,311	3,246	65	$ 532	$ 34,580	0.138	$ 4,772
2047	Red. City Demand	AFY	3,367	3,302	65	$ 532	$ 34,580	0.130	$ 4,495
2048	Red. City Demand	AFY	3,423	3,358	65	$ 532	$ 34,580	0.123	$ 4,253
2049	Red. City Demand	AFY	3,479	3,414	65	$ 532	$ 34,580	0.116	$ 4,011
2050	Red. City Demand	AFY	3,535	3,470	65	$ 532	$ 34,580	0.109	$ 3,769
2051	Red. City Demand	AFY	3,591	3,526	65	$ 532	$ 34,580	0.103	$ 3,562
2052	Red. City Demand	AFY	3,647	3,582	65	$ 532	$ 34,580	0.097	$ 3,354
2053	Red. City Demand	AFY	3,703	3,638	65	$ 532	$ 34,580	0.092	$ 3,181
2054	Red. City Demand	AFY	3,759	3,694	65	$ 532	$ 34,580	0.087	$ 3,008
2055	Red. City Demand	AFY	3,815	3,750	65	$ 532	$ 34,580	0.082	$ 2,836
2056	Red. City Demand	AFY	3,871	3,806	65	$ 532	$ 34,580	0.077	$ 2,663
2057	Red. City Demand	AFY	3,927	3,862	65	$ 532	$ 34,580	0.073	$ 2,524
2058	Red. City Demand	AFY	3,983	3,918	65	$ 532	$ 34,580	0.069	$ 2,386
2059	Red. City Demand	AFY	4,039	3,974	65	$ 532	$ 34,580	0.065	$ 2,248
2060	Red. City Demand	AFY	4,095	4,030	65	$ 532	$ 34,580	0.061	$ 2,109
2061	Red. City Demand	AFY	4,151	4,086	65	$ 532	$ 34,580	0.058	$ 2,006
2062	Red. City Demand	AFY	4,207	4,142	65	$ 532	$ 34,580	0.054	$ 1,877
2063	Red. City Demand	AFY	4,263	4,198	65	$ 532	$ 34,580	0.051	$ 1,771
2064	Red. City Demand	AFY	4,319	4,254	65	$ 532	$ 34,580	0.048	$ 1,671
			Total Present Value of Discounted Benefits Based on Unit Value						**$ 515,962**

Table 8.3-4: Annual Project Costs

Table 19 – Annual Costs of Project (All costs should be in 2012 Dollars) Project: Snyder Well Intertie Pipeline Project										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost	Annual Costs						Discounting Calculations	
			Admin	Operation	Maint.	Replcmt	Other	Total Costs (a) +…+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2014	**$626,321**		$300	$1,200	$3,300			$631,121	0.890	**$561,698**
2015			$300	$1,200	$3,300			$4,800	0.840	**$4,032**
2016			$300	$1,200	$3,300			$4,800	0.792	**$3,802**
2017			$300	$1,200	$3,300			$4,800	0.747	**$3,586**
2018			$300	$1,200	$3,300			$4,800	0.705	**$3,384**
2019			$300	$1,200	$3,300			$4,800	0.665	**$3,192**
2020			$300	$1,200	$3,300			$4,800	0.627	**$3,010**
2021			$300	$1,200	$3,300			$4,800	0.592	**$2,842**
2022			$300	$1,200	$3,300			$4,800	0.558	**$2,678**
2023			$300	$1,200	$3,300			$4,800	0.527	**$2,530**
2024			$300	$1,200	$3,300			$4,800	0.497	**$2,386**
2025			$300	$1,200	$3,300			$4,800	0.469	**$2,251**
2026			$300	$1,200	$3,300			$4,800	0.442	**$2,122**
2027			$300	$1,200	$3,300			$4,800	0.417	**$2,002**
2028			$300	$1,200	$3,300			$4,800	0.394	**$1,891**
2029			$300	$1,200	$3,300			$4,800	0.371	**$1,781**
2030			$300	$1,200	$3,300			$4,800	0.350	**$1,680**
2031			$300	$1,200	$3,300			$4,800	0.331	**$1,589**
2032			$300	$1,200	$3,300			$4,800	0.312	**$1,498**
2033			$300	$1,200	$3,300			$4,800	0.294	**$1,411**
2034			$300	$1,200	$3,300			$4,800	0.278	**$1,334**
2035			$300	$1,200	$3,300			$4,800	0.262	**$1,258**
2036			$300	$1,200	$3,300			$4,800	0.247	**$1,186**
2037			$300	$1,200	$3,300			$4,800	0.233	**$1,118**
2038			$300	$1,200	$3,300			$4,800	0.220	**$1,056**
2039			$300	$1,200	$3,300			$4,800	0.207	**$994**
2040			$300	$1,200	$3,300			$4,800	0.196	**$941**
2041			$300	$1,200	$3,300			$4,800	0.185	**$888**
2042			$300	$1,200	$3,300			$4,800	0.174	**$835**
2043			$300	$1,200	$3,300			$4,800	0.164	**$787**
2044			$300	$1,200	$3,300			$4,800	0.155	**$744**
2045			$300	$1,200	$3,300			$4,800	0.146	**$701**
2046			$300	$1,200	$3,300			$4,800	0.138	**$662**
2047			$300	$1,200	$3,300			$4,800	0.130	**$624**
2048			$300	$1,200	$3,300			$4,800	0.123	**$590**
2049			$300	$1,200	$3,300			$4,800	0.116	**$557**
2050			$300	$1,200	$3,300			$4,800	0.109	**$523**
2051			$300	$1,200	$3,300			$4,800	0.103	**$494**
2052			$300	$1,200	$3,300			$4,800	0.097	**$466**
2053			$300	$1,200	$3,300			$4,800	0.092	**$442**
2054			$300	$1,200	$3,300			$4,800	0.087	**$418**
2055			$300	$1,200	$3,300			$4,800	0.082	**$394**
2056			$300	$1,200	$3,300			$4,800	0.077	**$370**
2057			$300	$1,200	$3,300			$4,800	0.073	**$350**
2058			$300	$1,200	$3,300			$4,800	0.069	**$331**
2059			$300	$1,200	$3,300			$4,800	0.065	**$312**
2060			$300	$1,200	$3,300			$4,800	0.061	**$293**
2061			$300	$1,200	$3,300			$4,800	0.058	**$278**
2062			$300	$1,200	$3,300			$4,800	0.054	**$259**
2063			$300	$1,200	$3,300			$4,800	0.051	**$245**
2064			$300	$1,200	$3,300			$4,800	0.048	**$230**
								Total Present Value of Discounted Costs (Sum of column (j))		**$629,042**
								Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries		
Comments: Admin assumed to be 1 hr/mon, Operation assumed to be 4 hr/mon, Maintenance assumed to be 25 hr/yr + $2000 for materials and equipment.										

8.4 Kern Water Bank Recharge and Recovery Enhancement Project

8.4.1 Summary

The proposed Project will add a net of 189 additional acres of recharge ponds connected to existing KWBA conveyance facilities that will allow KWBA to receive more wet period water from a number of sources. The Project will also add three additional wells with associated equipment, recovery pipelines, and connections to larger existing KWBA conveyance facilities which allow recovery of more water to KWBA members via the California Aqueduct and existing exchange mechanisms.

Without the project, dry period water demands of KWBA Members will be unmet, and those Members will turn to the California Water Market for an alternative to KWBA's banked water at times when market prices are typically very high.

Additionally, in the without-Project scenario, adjoining entity overdraft conditions would be exacerbated and those entities would also have to purchase additional water on the California water market for delivery to their customers or recharge in their own recharge facilities, but not always during times when prices are high. Without the project, there also would be less water stored in the Kern Water Bank and Kern Fan area.

The Project's Primary Physical Benefit will be increased dry period water supplies (acre-feet per year) for KWBA Members during the Project's useful life (assumed to be 50 years), which correlate to annual volumes recovered from the Project's wells. Also, water recharged but not recovered for KWBA Members results in two other Physical Benefits. Firstly under the KWB MOU, adjoining entities purchase 4% of total water recharged in the ponds for overdraft correction. This increase in overdraft correction water (acre-feet per year) is another Physical Benefit. Then, at the end of the Project's useful life, the amount of water recharged, but not recovered by KWBA Members, nor lost to evaporation or purchased by adjoining districts for overdraft correction (in total acre-feet) would still be stored underground, and have a remaining value to KWBA Members for dry year supplies. All of these benefits have been included in the Monetized Benefits Analysis Tables for the Project.

In summary, the three monetized benefits were:

1. ***Increased Dry Period Water Supplies***
2. ***Increased Overdraft Protection Water***
3. ***Increased Groundwater Storage***

A summary of all benefits and costs of the project are provided in **Table 8.4-1**. Both monetized and non-monetized benefits are presented in this attachment, while physically quantified (but not monetized) benefits are described in Attachment 7.

Table 8.4-1: Benefit-Cost Analysis Overview

	Present Value
Costs – Total Capital and O&M	**$7,839,349**
Monetizable Benefits	
Benefit 'a' – Increased Dry Period Water Supply	**$11,634,029**
Benefit 'b' – Increased Overdraft Correction Water	**$662,306**
Benefit 'c' – Increased Groundwater Storage	**$1,308,961**
Total Monetizable Benefits	**$13,605,296**

Qualitative Benefit or Cost	**Qualitative Indicator***
Help avoid, reduce or resolve various public water resources conflicts	++
Benefit wildlife or habitat in ways that were not quantified in Attachment 7	++
Improve water quality in ways that were not quantified in Attachment 7	+
Improved Water Supply Reliability Improve the overall, long-term management of California groundwater resources	+
Reduce demand for net diversions for the regions from the Delta	++
Provide a long-term solution in place of a short term one	+
Improve water supply reliability in ways not quantified in Attachment 7	+
Other (groundwater lift reduction associated with stored water in Kern Fan area and flood damage reduction to developed areas)	++

* Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
+ + = Likely to increase net benefits significantly.
– = Likely to decrease net benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or – .

Ac-ft = acre feet.

8.4.2 Non-monetized Benefits Analysis (Section D2)

As discussed in Attachment 7 and Section D3 below, this project will result in increased dry period water supply, increased overdraft correction water, and increased groundwater storage. However, the proposed project will also result in a number of benefits that cannot be easily quantified, but are also important. These benefits are qualitatively described in this section.

Table 8.4-2 shows the non-monetized benefits checklist for the project (using Table 12 from Exhibit C of the IRWM PSP). Narrative descriptions of the benefit categories marked "Yes" in the table are provided in the section following the table. It is important to note that this table is intended to only identify benefits of the project that cannot be monetized. Thus although a benefit might apply, a "No" is entered into the table if the benefit has been physically quantified and/or monetized.

Table 8.4-2: Non-monetized Benefits Checklist

Table 12 – Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	Community/Social Benefits **Will the proposal**	
1	**Provide education or technology benefits?**	No
	Examples are not limited to, but may include: - Include educational features that should result in water supply, water quality, or flood damage reduction benefits? - Develop, test, or document a new technology for water supply, water quality, or flood damage reduction management? - Provide some other education or technological benefit?	
2	**Provide social recreation or access benefits?**	No
	Examples are not limited to, but may include: - Provide new or improved outdoor recreation opportunities? - Provide more access to open space? - Provide some other recreation or public access benefit?	
3	**Help avoid, reduce or resolve various public water resources conflicts?**	**Yes**
	Examples are not limited to, but may include: - Provide more opportunities for public involvement in water management? - Help avoid or resolve an existing conflict as evidenced by recurring fines or litigation? - Help meet an existing state mandate (e.g., water quality, water conservation, flood control)?	
4	**Promote social health and safety?**	No
	Examples are not limited to, but may include: - Increase urban water supply reliability for fire-fighting and critical services following seismic events? - Reduce risk to life from dam failure or flooding?	

Table 12 – Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	- Reduce exposure to water-related hazards?	
5	**Have other social benefits?**	No
	Examples are not limited to, but may include: - Redress or increase inequitable distribution of environmental burdens? - Have disproportionate beneficial or adverse effects on disadvantaged communities, Native Americans, or other distinct cultural groups?	
	Environmental Stewardship Benefits: **Will the proposal**	
6	**Benefit wildlife or habitat in ways that were not quantified in Attachment 7?**	**Yes**
	Examples are not limited to, but may include: - Cause an increase in the amount or quality of terrestrial, aquatic, riparian or wetland habitat? - Contribute to an existing biological opinion or recovery plan for a listed special status species? - Preserve or restore designated critical habitat of a listed species? - Enhance wildlife protection or habitat?	
7	**Improve water quality in ways that were not quantified in Attachment 7?**	**Yes**
	Examples are not limited to, but may include: - Cause an improvement in water quality in an impaired water body or sensitive habitat? - Prevent water quality degradation? - Cause some other improvement in water quality?	
8	**Reduce net emissions in ways that were not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Reduce net production of greenhouse gasses? - Reduce net emissions of other harmful chemicals into the air or water?	
9	**Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?**	No
	Sustainability Benefits: **Will the proposal**	
10	**Improve the overall, long-term management of California groundwater resources?**	**Yes**
	Examples are not limited to, but may include: - Reduce extraction of non-renewable groundwater? - Promote aquifer storage or recharge?	
11	**Reduce demand for net diversions for the regions from the Delta?**	**Yes**
12	**Provide a long-term solution in place of a short-term one?**	**Yes**
13	**Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?**	No
	Examples are not limited to, but may include:	

Table 12 – Non-monetized Benefits Checklist		
No.	**Question**	**Enter "Yes", "No" or "Neg"**
	- Reduce net energy use on a permanent basis? - Increase renewable energy production? - Include new buildings or modify buildings to include certified LEED features? - Provide a net increase in recycling or reuse of materials? - Replace unsustainable land or water management practices with recognized sustainable practices?	
14	**Improve water supply reliability in ways not quantified in Attachment 7?**	**Yes**
	Examples are not limited to, but may include: - Provide a more flexible mix of water sources? - Reduce likelihood of catastrophic supply outages? - Reduce supply uncertainty? - Reduce supply variability?	
15	**Other (If the above listed categories do not apply, provide non-monetized benefit description)?**	**Yes**

8.4.3 Narrative Description of Qualitative Benefits

Descriptions of the non-monetized benefits marked "Yes" from the checklist in Table 8-2 are described below.

Help avoid, reduce or resolve various public water resources conflicts?

The Project increases flexibility to manage KWBA recharge and recovery options to avoid banking project impacts to adjoining entities

The Project will help KWBA members (both agricultural and urban water users)meet existing state mandates to conserve water under their respective water management programs required by SBx7-7 and improve groundwater quality (such as the Irrigated Lands Regulatory Program to reduce salt and nitrates in groundwater).

Benefit wildlife habitat in ways that were no quantified in Attachment 7?

The Project increases intermittent wetland habitat for water birds, and aids in the recovery of listed species (including the tri-colored blackbird). And, the Project will enhance existing wetland habitat on the KWB, benefitting water birds and other species dependent on this habitat

Improve water quality in ways that were not quantified in Attachment 7?

Recharge of high quality surface water in the new ponds, and recovery of slightly lower groundwater quality will reduce the concentration of salts, nitrate, and arsenic in Kern Fan groundwater

Improve the overall, long-term management of California groundwater resources?

Without the Project, there would likely be increased recovery of groundwater in other areas for sale into the California water market. Also without the Project, minor migration losses (not accounted to adjoining entities) would also not occur. Thus additional improvement in the overall, long-term management of California's groundwater resources occurs with the Project in addition to the three monetized benefits.

Reduce demand for net diversions for the regions from the Delta?

Without the Project, additional market water purchased by KWBA members and adjoining entities would occur. Most of this would likely come from Northern California water exported from the Delta to the California Aqueduct. Thus the Project has the effect of reduced demand for net diversions from the Delta for the Region.

Provide a long-term solution in place of a short-term one?

Additional market water purchases without the Project are short-term solutions (usually arranged on a year to year basis). Whereas the Project provides a long-term solution.

Improve water supply reliability in ways not quantified in Attachment 7?

Groundwater banking provides a more reliable supply than the alternative of year to year water market purchases, which are less reliable. Also, improvements in recharge and recovery options of KWBA to meet KWB MOU (discussed above) reduces the uncertainty and therefore reliability of the Kern Water Bank's supplies to KWBA Members.

Other (If the above listed categories do not apply, provide non-monetized benefit)?

There is a reduction in groundwater lift (thus reduced energy use and pumping cost) associated with stored water in the Kern Fan area that is realized by both KWBA and its neighbors. Developed land in low lying areas of the San Joaquin Valley that would otherwise be flooded by some of the water recharged during wet periods in the new ponds will be avoided.

8.4.4 Monetized Benefits Analysis (Section D3)

A Monetized Benefit Cost Analysis was prepared for the Project using "DWR Method" for quantifiable Project Benefits that correspond to "Primary Physical Benefits" described and quantified in ATTACHMENT 7 JUSTIFICATION OF PROJECTS (and summarized in its tables, corresponding to Table 7.4-1, 7.4-2, and 7.4-3).

As described in ATTACHMENT 7, in Table 7.4-1 the Annual Project Physical Benefit of Increased Dry Period Water Supplies for KWBA Members With Project, in acre-feet per year for a 50 year analysis period With Project are seen in Column (c). These numbers correspond to water volumes recovered from the Project's new wells, which are assumed to be available for recovery in the year 2015 per the Project Schedule. Without the Project in Column (b), KWBA Members are assumed to have 0 acre-feet

each year, and would purchase an equivalent amount of water in California's dry year water market. Column (d) calculates the Change Resulting from Project (b) – (c).

Therefore, in **Table 8.4-3** Annual Benefits of the Project correspond to the three types of Project Benefits in Physical Benefits Tables 7.4-1, 7.4-2, and 7.4-3. For each year of the analysis period three rows (labeled a, b, and c) are shown corresponding to information brought forward from Tables 7.4-1, 7.4-2, and 7.4-3.

For rows labeled "a" in **Table 8.4-3**, increased dry period water supplies in acre-feet populate column (e). Column (f) representing the incremental improvement versus Without the Project is multiplied by column (g), which is the calculated avoided cost (from a relationship described in the next paragraph) KWBA Members would have paid for State Water Project per AF at the SWP allocation indicated in the analysis period's corresponding year of DWR's Table 6 of its 2010 SWP Water Supply Reliability Report.

Table 8.4-3: Kern Water Bank Recharge and Recovery Enhancement Project - Annual Benefit

Table 15 – Annual Benefit Project: Kern Water Bank Authority - Recharge and Recovery Enhancement Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit[2]	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value [1]	Annual $ Value [1] (f) x (g)	Discount Factor [1]	Discounted Benefits [1] (h) x (i)
2013	a	AC-FT	0	0	0	$179	$0	0.943	**$0**
2013	b	AC-FT	0	0	0	$191	$0	0.943	**$0**
2013	c	AC-FT	0	0	0	$191	$0	0.943	**$0**
2014	a	AC-FT	0	0	0	$174	$0	0.89	**$0**
2014	b	AC-FT	0	0	0	$191	$0	0.89	**$0**
2014	c	AC-FT	0	0	0	$191	$0	0.89	**$0**
2015	a	AC-FT	0	10,867	10867	$398	$4,324,174	0.84	**$3,632,306**
2015	b	AC-FT	0	414	414	$191	$79,247	0.84	**$66,568**
2015	c	AC-FT	0	0	0	$191	$0	0.84	**$0**
2016	a	AC-FT	0	3,622	3622	$282	$1,022,751	0.792	**$810,018**
2016	b	AC-FT	0	759	759	$191	$145,285	0.792	**$115,066**
2016	c	AC-FT	0	0	0	$191	$0	0.792	**$0**
2017	a	AC-FT	0	3,622	3622	$235	$851,423	0.747	**$636,013**
2017	b	AC-FT	0	69	69	$191	$13,209	0.747	**$9,867**
2017	c	AC-FT	0	0	0	$191	$0	0.747	**$0**
2018	a	AC-FT	0	0	0	$154	$0	0.705	**$0**
2018	b	AC-FT	0	69	69	$191	$13,209	0.705	**$9,312**
2018	c	AC-FT	0	0	0	$191	$0	0.705	**$0**
2019	a	AC-FT	0	0	0	$154	$0	0.665	**$0**
2019	b	AC-FT	0	69	69	$191	$13,209	0.665	**$8,784**
2019	c	AC-FT	0	0	0	$191	$0	0.665	**$0**
2020	a	AC-FT	0	3,622	3622	$320	$1,159,338	0.627	**$726,905**
2020	b	AC-FT	0	621	621	$191	$118,867	0.627	**$74,530**
2020	c	AC-FT	0	0	0	$191	$0	0.627	**$0**
2021	a	AC-FT	0	3,622	3622	$288	$1,042,085	0.592	**$616,914**
2021	b	AC-FT	0	69	69	$191	$13,209	0.592	**$7,820**
2021	c	AC-FT	0	0	0	$191	$0	0.592	**$0**
2022	a	AC-FT	0	10,867	10867	$353	$3,836,552	0.558	**$2,140,796**
2022	b	AC-FT	0	0	0	$191	$0	0.558	**$0**
2022	c	AC-FT	0	0	0	$191	$0	0.558	**$0**

Table 15 – Annual Benefit
Project: Kern Water Bank Authority - Recharge and Recovery Enhancement Project

(a) Year	(b) Type of Benefit[2]	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value [1]	(h) Annual $ Value [1] (f) x (g)	(i) Discount Factor [1]	(j) Discounted Benefits [1] (h) x (i)
2023	a	AC-FT	0	3,622	3622	$298	$1,080,931	0.527	**$569,651**
2023	b	AC-FT	0	690	690	$191	$132,076	0.527	**$69,604**
2023	c	AC-FT	0	0	0	$191	$0	0.527	**$0**
2024	a	AC-FT	0	3,622	3622	$298	$1,080,931	0.497	**$537,223**
2024	b	AC-FT	0	621	621	$191	$118,867	0.497	**$59,077**
2024	c	AC-FT	0	0	0	$191	$0	0.497	**$0**
2025	a	AC-FT	0	5,433	5433	$336	$1,828,151	0.469	**$857,403**
2025	b	AC-FT	0	552	552	$191	$105,658	0.469	**$49,554**
2025	c	AC-FT	0	0	0	$191	$0	0.469	**$0**
2026	a	AC-FT	0	0	0	$174	$0	0.442	**$0**
2026	b	AC-FT	0	69	69	$191	$13,209	0.442	**$5,838**
2026	c	AC-FT	0	0	0	$191	$0	0.442	**$0**
2027	a	AC-FT	0	0	0	$159	$0	0.417	**$0**
2027	b	AC-FT	0	69	69	$191	$13,209	0.417	**$5,508**
2027	c	AC-FT	0	0	0	$191	$0	0.417	**$0**
2028	a	AC-FT	0	0	0	$101	$0	0.394	**$0**
2028	b	AC-FT	0	552	552	$191	$105,658	0.394	**$41,629**
2028	c	AC-FT	0	0	0	$191	$0	0.394	**$0**
2029	a	AC-FT	0	0	0	$14	$0	0.371	**$0**
2029	b	AC-FT	0	69	69	$191	$13,209	0.371	**$4,901**
2029	c	AC-FT	0	0	0	$191	$0	0.371	**$0**
2030	a	AC-FT	0	3,622	3622	$245	$889,079	0.35	**$311,178**
2030	b	AC-FT	0	0	0	$191	$0	0.35	**$0**
2030	c	AC-FT	0	0	0	$191	$0	0.35	**$0**
2031	a	AC-FT	0	0	0	$179	$0	0.331	**$0**
2031	b	AC-FT	0	69	69	$191	$13,209	0.331	**$4,372**
2031	c	AC-FT	0	0	0	$191	$0	0.331	**$0**
2032	a	AC-FT	0	0	0	$130	$0	0.312	**$0**
2032	b	AC-FT	0	0	0	$191	$0	0.312	**$0**
2032	c	AC-FT	0	0	0	$191	$0	0.312	**$0**
2033	a	AC-FT	0	0	0	$154	$0	0.294	**$0**
2033	b	AC-FT	0	69	69	$191	$13,209	0.294	**$3,883**

Table 15 – Annual Benefit
Project: Kern Water Bank Authority - Recharge and Recovery Enhancement Project

(a) Year	(b) Type of Benefit[2]	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value [1]	(h) Annual $ Value [1] (f) x (g)	(i) Discount Factor [1]	(j) Discounted Benefits [1] (h) x (i)
2033	c	AC-FT	0	0	0	$191	$0	0.294	**$0**
2034	a	AC-FT	0	0	0	$135	$0	0.278	**$0**
2034	b	AC-FT	0	69	69	$191	$13,209	0.278	**$3,672**
2034	c	AC-FT	0	0	0	$191	$0	0.278	**$0**
2035	a	AC-FT	0	2,717	2717	$214	$582,726	0.262	**$152,674**
2035	b	AC-FT	0	69	69	$191	$13,209	0.262	**$3,461**
2035	c	AC-FT	0	0	0	$191	$0	0.262	**$0**
2036	a	AC-FT	0	0	0	$140	$0	0.247	**$0**
2036	b	AC-FT	0	621	621	$191	$118,867	0.247	**$29,360**
2036	c	AC-FT	0	0	0	$191	$0	0.247	**$0**
2037	a	AC-FT	0	0	0	$174	$0	0.233	**$0**
2037	b	AC-FT	0	138	138	$191	$26,418	0.233	**$6,155**
2037	c	AC-FT	0	0	0	$191	$0	0.233	**$0**
2038	a	AC-FT	0	2,717	2717	$204	$555,014	0.22	**$122,103**
2038	b	AC-FT	0	69	69	$191	$13,209	0.22	**$2,906**
2038	c	AC-FT	0	0	0	$191	$0	0.22	**$0**
2039	a	AC-FT	0	0	0	$194	$0	0.207	**$0**
2039	b	AC-FT	0	0	0	$191	$0	0.207	**$0**
2039	c	AC-FT	0	0	0	$191	$0	0.207	**$0**
2040	a	AC-FT	0	2,717	2717	$209	$568,847	0.196	**$111,494**
2040	b	AC-FT	0	69	69	$191	$13,209	0.196	**$2,589**
2040	c	AC-FT	0	0	0	$191	$0	0.196	**$0**
2041	a	AC-FT	0	0	0	$194	$0	0.185	**$0**
2041	b	AC-FT	0	138	138	$191	$26,418	0.185	**$4,887**
2041	c	AC-FT	0	0	0	$191	$0	0.185	**$0**
2042	a	AC-FT	0	0	0	$140	$0	0.174	**$0**
2042	b	AC-FT	0	621	621	$191	$118,867	0.174	**$20,683**
2042	c	AC-FT	0	0	0	$191	$0	0.174	**$0**
2043	a	AC-FT	0	0	0	$87	$0	0.164	**$0**
2043	b	AC-FT	0	0	0	$191	$0	0.164	**$0**
2043	c	AC-FT	0	0	0	$191	$0	0.164	**$0**
2044	a	AC-FT	0	0	0	$179	$0	0.155	**$0**

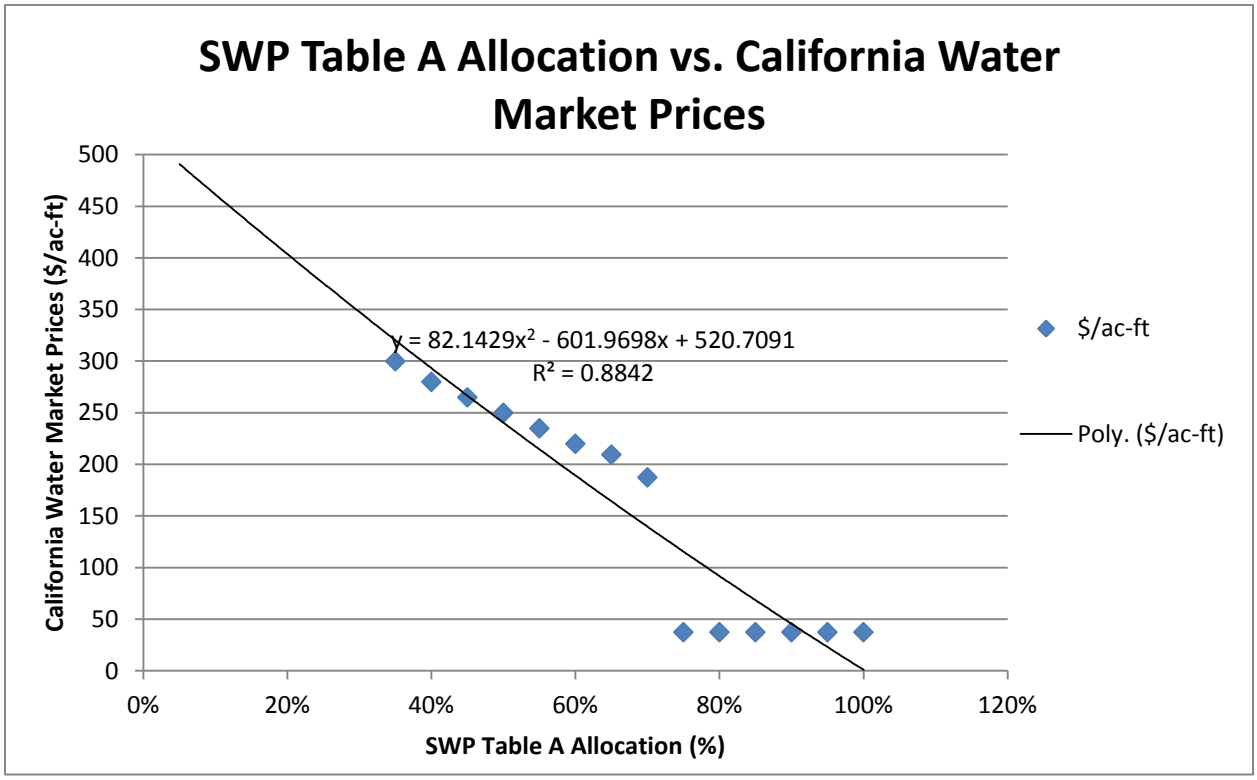
Table 15 – Annual Benefit Project: Kern Water Bank Authority - Recharge and Recovery Enhancement Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit[2]	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value [1]	Annual $ Value [1] (f) x (g)	Discount Factor [1]	Discounted Benefits [1] (h) x (i)
2044	b	AC-FT	0	138	138	$191	$26,418	0.155	**$4,095**
2044	c	AC-FT	0	0	0	$191	$0	0.155	**$0**
2045	a	AC-FT	0	0	0	$194	$0	0.146	**$0**
2045	b	AC-FT	0	69	69	$191	$13,209	0.146	**$1,929**
2045	c	AC-FT	0	0	0	$191	$0	0.146	**$0**
2046	a	AC-FT	0	3,622	3622	$277	$1,003,476	0.138	**$138,480**
2046	b	AC-FT	0	69	69	$191	$13,209	0.138	**$1,823**
2046	c	AC-FT	0	0	0	$191	$0	0.138	**$0**
2047	a	AC-FT	0	0	0	$111	$0	0.13	**$0**
2047	b	AC-FT	0	759	759	$191	$145,285	0.13	**$18,887**
2047	c	AC-FT	0	0	0	$191	$0	0.13	**$0**
2048	a	AC-FT	0	0	0	$194	$0	0.123	**$0**
2048	b	AC-FT	0	138	138	$191	$26,418	0.123	**$3,249**
2048	c	AC-FT	0	0	0	$191	$0	0.123	**$0**
2049	a	AC-FT	0	0	0	$68	$0	0.116	**$0**
2049	b	AC-FT	0	138	138	$191	$26,418	0.116	**$3,065**
2049	c	AC-FT	0	0	0	$191	$0	0.116	**$0**
2050	a	AC-FT	0	3,622	3622	$235	$851,423	0.109	**$92,805**
2050	b	AC-FT	0	69	69	$191	$13,209	0.109	**$1,440**
2050	c	AC-FT	0	0	0	$191	$0	0.109	**$0**
2051	a	AC-FT	0	3,622	3622	$256	$926,974	0.103	**$95,478**
2051	b	AC-FT	0	69	69	$191	$13,209	0.103	**$1,361**
2051	c	AC-FT	0	0	0	$191	$0	0.103	**$0**
2052	a	AC-FT	0	3,622	3622	$235	$851,423	0.097	**$82,588**
2052	b	AC-FT	0	0	0	$191	$0	0.097	**$0**
2052	c	AC-FT	0	0	0	$191	$0	0.097	**$0**
2053	a	AC-FT	0	0	0	$164	$0	0.092	**$0**
2053	b	AC-FT	0	0	0	$191	$0	0.092	**$0**
2053	c	AC-FT	0	0	0	$191	$0	0.092	**$0**
2054	a	AC-FT	0	0	0	$189	$0	0.087	**$0**
2054	b	AC-FT	0	138	138	$191	$26,418	0.087	**$2,298**
2054	c	AC-FT	0	0	0	$191	$0	0.087	**$0**

Table 15 – Annual Benefit
Project: Kern Water Bank Authority - Recharge and Recovery Enhancement Project

(a) Year	(b) Type of Benefit[2]	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value [1]	(h) Annual $ Value [1] (f) x (g)	(i) Discount Factor [1]	(j) Discounted Benefits [1] (h) x (i)
2055	a	AC-FT	0	0	0	$179	$0	0.082	**$0**
2055	b	AC-FT	0	69	69	$191	$13,209	0.082	**$1,083**
2055	c	AC-FT	0	0	0	$191	$0	0.082	**$0**
2056	a	AC-FT	0	0	0	$159	$0	0.077	**$0**
2056	b	AC-FT	0	69	69	$191	$13,209	0.077	**$1,017**
2056	c	AC-FT	0	0	0	$191	$0	0.077	**$0**
2057	a	AC-FT	0	0	0	$169	$0	0.073	**$0**
2057	b	AC-FT	0	69	69	$191	$13,209	0.073	**$964**
2057	c	AC-FT	0	0	0	$191	$0	0.073	**$0**
2058	a	AC-FT	0	0	0	$101	$0	0.069	**$0**
2058	b	AC-FT	0	69	69	$191	$13,209	0.069	**$911**
2058	c	AC-FT	0	0	0	$191	$0	0.069	**$0**
2059	a	AC-FT	0	0	0	$189	$0	0.065	**$0**
2059	b	AC-FT	0	69	69	$191	$13,209	0.065	**$859**
2059	c	AC-FT	0	0	0	$191	$0	0.065	**$0**
2060	a	AC-FT	0	0	0	$27	$0	0.061	**$0**
2060	b	AC-FT	0	276	276	$191	$52,829	0.061	**$3,223**
2060	c	AC-FT	0	0	0	$191	$0	0.061	**$0**
2061	a	AC-FT	0	0	0	$135	$0	0.058	**$0**
2061	b	AC-FT	0	483	483	$191	$92,456	0.058	**$5,362**
2061	c	AC-FT	0	0	0	$191	$0	0.058	**$0**
2062	a	AC-FT	0	0	0	$184	$0	0.054	**$0**
2062	b	AC-FT	0	69	69	$191	$13,209	0.054	**$713**
2062	c	AC-FT	0	126,695	126695	$191	$24,240,024	0.054	**$1,308,961**
							Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)		**$13,605,296**

Comments:

A review of recent California water market and delivery prices was conducted by interviewing Dale Melville, Dudley Ridge Water District's Manager, and lead consultant on water procurement for five KWBA members. Mr. Melville can be reached at (559) 449-2700 and dmelville@ppeng.com. He indicated that prices for water vary strongly with State Water Project (SWP) Table A allocation in a given year. From information he provided, a relationship between market and delivery prices versus SWP Table A allocation was developed for use in estimating avoided cost benefits per acre-foot for Benefit 1.



Likewise, benefits resulting from quantities of water brought forward from Table 7.4-2 are similarly calculated, and represent avoided cost of purchasing overdraft correction water. However for this Benefit 2 (Increased Overdraft Correction Water), an average water market price (with delivery to KWBA members) for the whole analysis period is used (rather than a price for that specific year). This is because without the Project, adjoining entities would have been able to purchase water for overdraft correction deliveries at any time (not just dry periods).

Similarly, benefits resulting from quantities of water brought forward from Table 7.4-3 for Benefit 3, (Increased Groundwater Storage) are accounted in the last year of the analysis period (even though KWBA could realize it sooner by doing "in-ground" transfer to other local agencies). The average cost of California water market price plus delivery to KWBA members for the whole analysis period is also used for the price of this water, which could have been sold at any time. For economic analysis purposes, this avoids "stranding" the valuable asset of un-recovered groundwater that KWBA members have title to. Furthermore, putting the benefit at the end of the analysis period at the average water price is conservative.

Annual Cost of Avoided Projects

Table 8.4-4 (DWR Table 16) Avoided Project Costs are all zero, because there is no "alternative project". Tables 17 and 18 were not utilized for estimating flood damage reduction, because those benefits could not be quantified readily.

8.4.5 Project Economic Costs

Table 8.4-5 (DWR Table 19) "Annual Costs of Projects" was used to calculate Annual Costs of the Project. In that table, Initial Grand Total Cost from Table 7 have been distributed in Column (a) from 2013 through 2015 corresponding to expected years that those cost will be incurred. No adjustment for opportunity costs, sunk costs and associated costs were deemed applicable, so Column (b) is equal to Column (a).

Costs associated with the Project include the cost KWBA Members pay to deliver wet period water water to KWBA from the various sources, and for KWBA to convey it to the new Ponds. These costs were provided by Ken Bonesteel of KWBA and are summarized in the following Table:

Recharge Water Costs to KWBA Members

Agency	Source	Cost/ac-ft	KWBA Conveyance Cost/ac-ft	% Use	Melded
DWR	SWP	$22	$15.25	60.00%	$22.35
COB	Kern River	$2	$9.50	23.00%	$2.65
USBR	Friant	$18	$9.50	17.00%	$4.68
				Total	$29.67

Thus a "melded" $29.67 per acre-foot is the cost assumed for every acre-foot of recharge occurring in a given year, with percent use numbers taken from historic Kern Water Bank operations from 1995 to 2012 provided by Ken Bonesteel. The amount of total recharge water in a given year comes from calculations described in ATTACHMENT 7.

In addition KWBA members pay to recover groundwater from the Kern Water Bank, and deliver it back to the California Aqueduct. These costs were also provided by Ken Bonesteel, as shown in the following table.

Recovery Costs to KWBA Members

Capital	$20.00	ac/ft		
O&M	$7.00	ac/ft		
Energy Winter	$40.00		50%	
Energy Summer	$60.00		50%	May-Oct
Energy Average	$50.00			
Total	$77.00			

Table 8.4-4: Kern Water Bank Recharge and Recovery Enhancement Project – Avoided Project Costs

Table 8 – Avoided Project Costs Project: Kern Water Bank Recharge and Recovery Enhancement Project						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): N/A Avoided Project Description: N/A				Discount Factor	Discounted Costs (e) x (f)
	Avoided Capital Costs - (none)	Avoided Replacement Costs - (none)	Avoided Operations and Maintenance Costs - avoided purchase from water market	Total Cost Avoided for Individual Alternatives (b) + (c) + (d)		
2012	0	0	$0	$0	1.000	**$0**
2013	0	0	$0	$0	0.943	**$0**
2014	0	0	$0	$0	0.899	**$0**
2015	0	0	$0	$0	0.839	**$0**
2016	0	0	$0	$0	0.792	**$0**
2017	0	0	$0	$0	0.747	**$0**
2018	0	0	$0	$0	0.705	**$0**
2019	0	0	$0	$0	0.665	**$0**
2020	0	0	$0	$0	0.627	**$0**
2021	0	0	$0	$0	0.592	**$0**
2022	0	0	$0	$0	0.558	**$0**
2023	0	0	$0	$0	0.527	**$0**
2024	0	0	$0	$0	0.497	**$0**
2025	0	0	$0	$0	0.469	**$0**
2026	0	0	$0	$0	0.442	**$0**
2027	0	0	$0	$0	0.417	**$0**
2028	0	0	$0	$0	0.394	**$0**
2029	0	0	$0	$0	0.371	**$0**
2030	0	0	$0	$0	0.350	**$0**
2031	0	0	$0	$0	0.331	**$0**

Table 8 – Avoided Project Costs Project: Kern Water Bank Recharge and Recovery Enhancement Project						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): N/A Avoided Project Description: N/A				Discount Factor	Discounted Costs (e) x (f)
	Avoided Capital Costs - (none)	Avoided Replacement Costs - (none)	Avoided Operations and Maintenance Costs - avoided purchase from water market	Total Cost Avoided for Individual Alternatives (b) + (c) + (d)		
2032	0	0	$0	$0	0.312	**$0**
2033	0	0	$0	$0	0.294	**$0**
2034	0	0	$0	$0	0.278	**$0**
2035	0	0	$0	$0	0.262	**$0**
2036	0	0	$0	$0	0.247	**$0**
2037	0	0	$0	$0	0.233	**$0**
2038	0	0	$0	$0	0.220	**$0**
2039	0	0	$0	$0	0.207	**$0**
2040	0	0	$0	$0	0.196	**$0**
2041	0	0	$0	$0	0.185	**$0**
2042	0	0	$0	$0	0.174	**$0**
2043	0	0	$0	$0	0.164	**$0**
2044	0	0	$0	$0	0.155	**$0**
2045	0	0	$0	$0	0.146	**$0**
2046	0	0	$0	$0	0.138	**$0**
2047	0	0	$0	$0	0.130	**$0**
2048	0	0	$0	$0	0.123	**$0**
2049	0	0	$0	$0	0.116	**$0**
2050	0	0	$0	$0	0.109	**$0**
2051	0	0	$0	$0	0.103	**$0**
2052	0	0	$0	$0	0.097	**$0**

Table 8 – Avoided Project Costs Project: Kern Water Bank Recharge and Recovery Enhancement Project						
	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Year	Alternative (Avoided Project Name): N/A Avoided Project Description: N/A				Discount Factor	Discounted Costs (e) x (f)
	Avoided Capital Costs - (none)	Avoided Replacement Costs - (none)	Avoided Operations and Maintenance Costs - avoided purchase from water market	Total Cost Avoided for Individual Alternatives (b) + (c) + (d)		
2053	0	0	$0	$0	0.092	**$0**
2054	0	0	$0	$0	0.087	**$0**
2055	0	0	$0	$0	0.082	**$0**
2056	0	0	$0	$0	0.077	**$0**
2057	0	0	$0	$0	0.073	**$0**
2058	0	0	$0	$0	0.069	**$0**
2059	0	0	$0	$0	0.065	**$0**
2060	0	0	$0	$0	0.061	**$0**
2061	0	0	$0	$0	0.058	**$0**
2062	0	0	$0	$0	0.054	**$0**
					Total Present Value of Discounted Costs (Sum of Column (g))	**$0**
					(%) Avoided Cost Claimed by Project	**100%**
					Total Present Value of Discounted Avoided Project Costs Claimed by Alternative Project (Total Present Value of Discounted Costs x % Avoided Cost Claimed by Project)	**$0**
Comments: No Project is Avoided. But the need to purchase dry period water on the California Water Market, delivered to KWBA members via the California Aqueduct is avoided [shown in Column (d)]						

Table 8.4-5: Kern Water Bank Recharge and Recovery Enhancement Project – Annual Costs

Table 8 – Annual Costs Project: Kern Water Bank Authority Recharge and Recovery Enhancement Project										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost (no adjustment) (1)	Annual Costs						Discounting Calculations	
			Admin - (Not Separated)	Operation (Admin, O&M, Power)(2)	Maintenance (Not Separated)	Replacement (Wells in 40th year of operation)	Other - Adjoining Entity Payment(3)	Total Costs (b) +…+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2012	$0	$0	$0	$0	$0	$0	$0	$0	1.000	**$0**
2013	$36,070	$36,070	$0	$0	$0	$0	$0	$36,070	0.943	**$34,014**
2014	$1,522,980	$1,522,980	$0	$0	$0	$0	$0	$1,522,980	0.899	**$1,369,159**
2015	$1,522,980	$1,522,980	$0	$1,143,992	$0	$0	-$9,112	$2,657,860	0.839	**$2,229,945**
2016	$0	$0	$0	$842,149	$0	$0	-$16,706	$825,443	0.792	**$653,751**
2017	$0	$0	$0	$330,104	$0	$0	-$1,519	$328,585	0.747	**$245,453**
2018	$0	$0	$0	$51,210	$0	$0	-$1,519	$49,691	0.705	**$35,032**
2019	$0	$0	$0	$51,210	$0	$0	-$1,519	$49,691	0.665	**$33,045**
2020	$0	$0	$0	$739,728	$0	$0	-$13,668	$726,060	0.627	**$455,240**
2021	$0	$0	$0	$330,104	$0	$0	-$1,519	$328,585	0.592	**$194,522**
2022	$0	$0	$0	$836,759	$0	$0	$0	$836,759	0.558	**$466,912**
2023	$0	$0	$0	$790,939	$0	$0	-$15,187	$775,752	0.527	**$408,821**
2024	$0	$0	$0	$739,728	$0	$0	-$13,668	$726,060	0.497	**$360,852**
2025	$0	$0	$0	$827,965	$0	$0	-$12,149	$815,816	0.469	**$382,618**
2026	$0	$0	$0	$51,210	$0	$0	-$1,519	$49,691	0.442	**$21,963**
2027	$0	$0	$0	$51,210	$0	$0	-$1,519	$49,691	0.417	**$20,721**
2028	$0	$0	$0	$409,624	$0	$0	-$12,149	$397,475	0.394	**$156,605**
2029	$0	$0	$0	$51,210	$0	$0	-$1,519	$49,691	0.371	**$18,435**
2030	$0	$0	$0	$278,894	$0	$0	$0	$278,894	0.350	**$97,613**

Table 8 – Annual Costs Project: Kern Water Bank Authority Recharge and Recovery Enhancement Project										
	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost (no adjustment) (1)	Annual Costs						Discounting Calculations	
			Admin - (Not Separated)	Operation (Admin, O&M, Power)(2)	Maintenance (Not Separated)	Replacement (Wells in 40th year of operation)	Other - Adjoining Entity Payment(3)	Total Costs (b) +…+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2031	$0	$0	$0	$51,210	$0	$0	-$1,519	$49,691	0.331	**$16,448**
2032	$0	$0	$0	$0	$0	$0	$0	$0	0.312	**$0**
2033	$0	$0	$0	$51,210	$0	$0	-$1,519	$49,691	0.294	**$14,609**
2034	$0	$0	$0	$51,210	$0	$0	-$1,519	$49,691	0.278	**$13,814**
2035	$0	$0	$0	$260,419	$0	$0	-$1,519	$258,900	0.262	**$67,832**
2036	$0	$0	$0	$460,834	$0	$0	-$13,668	$447,166	0.247	**$110,450**
2037	$0	$0	$0	$102,421	$0	$0	-$3,038	$99,383	0.233	**$23,156**
2038	$0	$0	$0	$260,419	$0	$0	-$1,519	$258,900	0.220	**$56,958**
2039	$0	$0	$0	$0	$0	$0	$0	$0	0.207	**$0**
2040	$0	$0	$0	$260,419	$0	$0	-$1,519	$258,900	0.196	**$50,744**
2041	$0	$0	$0	$102,421	$0	$0	-$3,038	$99,383	0.185	**$18,386**
2042	$0	$0	$0	$460,834	$0	$0	-$13,668	$447,166	0.174	**$77,807**
2043	$0	$0	$0	$0	$0	$0	$0	$0	0.164	**$0**
2044	$0	$0	$0	$102,421	$0	$0	-$3,038	$99,383	0.155	**$15,404**
2045	$0	$0	$0	$51,210	$0	$0	-$1,519	$49,691	0.146	**$7,255**
2046	$0	$0	$0	$330,104	$0	$0	-$1,519	$328,585	0.138	**$45,345**
2047	$0	$0	$0	$563,255	$0	$0	-$16,706	$546,549	0.130	**$71,051**
2048	$0	$0	$0	$102,421	$0	$0	-$3,038	$99,383	0.123	**$12,224**
2049	$0	$0	$0	$102,421	$0	$0	-$3,038	$99,383	0.116	**$11,528**
2050	$0	$0	$0	$330,104	$0	$0	-$1,519	$328,585	0.109	**$35,816**
2051	$0	$0	$0	$330,104	$0	$0	-$1,519	$328,585	0.103	**$33,844**

Table 8 – Annual Costs
Project: Kern Water Bank Authority Recharge and Recovery Enhancement Project

	Initial Costs Grand Total Cost from Table 7 (row (i), column (d))	Adjusted Grant Total Cost (no adjustment) (1)	Annual Costs						Discounting Calculations	
			Admin - (Not Separated)	Operation (Admin, O&M, Power)(2)	Maintenance (Not Separated)	Replacement (Wells in 40th year of operation)	Other - Adjoining Entity Payment(3)	Total Costs (b) +…+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2052	$0	$0	$0	$278,894	$0	$0	$0	$278,894	0.097	**$27,053**
2053	$0	$0	$0	$0	$0	$0	$0	$0	0.092	**$0**
2054	$0	$0	$0	$102,421	$0	$0	-$3,038	$99,383	0.087	**$8,646**
2055	$0	$0	$0	$51,210	$0	$1,050,000	-$1,519	$1,099,691	0.082	**$90,175**
2056	$0	$0	$0	$51,210	$0	$0	-$1,519	$49,691	0.077	**$3,826**
2057	$0	$0	$0	$51,210	$0	$0	-$1,519	$49,691	0.073	**$3,627**
2058	$0	$0	$0	$51,210	$0	$0	-$1,519	$49,691	0.069	**$3,429**
2059	$0	$0	$0	$51,210	$0	$0	-$1,519	$49,691	0.065	**$3,230**
2060	$0	$0	$0	$204,812	$0	$0	-$6,075	$198,737	0.061	**$12,123**
2061	$0	$0	$0	$358,443	$0	$0	-$10,631	$347,812	0.058	**$20,173**
2062	$0	$0	$0	$51,210	$0	$0	-$1,519	$49,691	0.054	**$2,683**
								Total Present Value of Discounted Costs (Sum of column (j))		**$8,042,337**
								Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries		
									0.092	

A more detailed "KWBA Use Fees – Effective September 1, 2012" from which these figures are derived is provided in **Appendix 8.4-A.**

Both recharge and recovery costs described above are added together into the Column entitled "Operation (Admin, O&M, Power), while columns entitled "Admin – (Not Separated)" and "Maintenance (Not Separated)" have zeros, because those costs are captured in the "Operation" column, as they are not separately accounted by KWBA.

In Column (f) "Replacement" Wells were assumed to be replaced in the 40th year of operation at $300,000 per well, based on KWBA's very recent costs to replace 3 of its oldest wells (provided by Mr. Bonesteel). No other capital replacement costs are included, as KWBA's fees are designed to collect sufficient funds for capital replacements of other facilities.

Payments from adjoining entities for overdraft correction water (4% of total recharge) are made at the current DWR cost for "Variable, Off-Aqueduct Charge" delivered in Pool 12b, which varies, but averaged about $22/AF in 2012, according to Mr. Melville. Thus, Column (g) "Other – Adjoining Entity Payment" represents the reduction in KWBA Member costs (and thus the negative numbers) associated with those payments.

8.4.6 Omissions, Biases, and Uncertainties, and Their Effect on the Project

A review of omissions, biases, and uncertainties, and their effect on the Project is summarized in **Table 8.4-6**

Table 8.4-6: Omissions, Biases, and Uncertainties, and Their Effect on the Project

Benefit or Cost Category	Likely Impact on Net Benefits*	Comment
Recharge Costs	+	Uncertainty in availability of water for KWBA Members in future years exists due to on-going increased environmental and other demands for water. Thus recovery volumes could increase, and recharge volumes decrease versus assumptions. This would have the effect of increasing benefits versus costs, as less recharge water would be purchased, but more recovery would occur (versus without Project). More recovery has a stronger positive effect on benefit/cost ratio than less recharge water causes in the opposite direction.

*Direction and magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantified estimates.
U = Uncertain, could be + or – .

8.5 Sycamore Road Flood Reduction Project

This attachment has been prepared to document the monetized and qualitative benefits of completing the City of Arvin's Sycamore Road Flood Reduction Project (Sycamore Road Project) that were described in Attachment 7. The City of Arvin (City) is a Central Valley community with a median household income (MHI) of about $29,740 which at 48% of the statewide MHI is below the 60% MHI that characterizes "severely disadvantaged communities". In order for this project to be completed as intended, the City of Arvin requires grant funding to provide the capital resources to implement a project of this magnitude. The sections below will provide a summary of the project, summarize the physical benefits of the project, describe the qualitative non-monetized benefits of the project, describe how other monetized benefits are accrued, describe how flood damage reduction benefits are accrued, summarize the "with project" and "without project" conclusions, and provide tables that depict the annual project costs and monetized benefits.

8.5.1 Project Summary

The Sycamore Road Project is being proposed to update and improve an inefficient surface drainage system with sub-surface stormwater and flood water infrastructure that is intended to meet multiple IRWM Plan objectives. In addition to protecting public and private property from flood damage and improving regional flood management, the project will increase public safety, and reduce operation and maintenance costs for this severely economically disadvantaged community. The specific physical benefits and the methods of estimating these benefits are described in detail in Attachment 7.

The Sycamore Road Project will effectively convey stormwater from surrounding neighborhoods and public roadways that contribute to flooding along Sycamore Road, nearby intersections, and threatens the mobile home park. This stormwater will be conveyed by 2.4 miles of sub-surface storm drain piping of 21-inch to 48-inch diameter that will carry the water to a proposed, 36 acre-foot capacity regional retention basin to the south. This will reduce or eliminate the accumulation of flood water along Sycamore Road, reduce potential flood damage to homes, vehicles, and roadways, and increase public safety and property values.

A summary of all benefits and costs of the project are provided in **Table 8.5-1.** Monetized benefits and non-monetized benefits are presented in this attachment, while physically quantified (but not monetized) benefits are described in Attachment 7.

Table 8.5-1 Benefit-Cost Analysis Overview

	Present Value
Costs – Total Capital and Operations and Maintenance	$3,443,882
D1 Cost Effectiveness Analysis	Not applicable
D2 Non-monetized Benefit	**Qualitative Indicator***
Community/Social Benefits	
Promote social health and safety	++
Increase local property values	+
Other Social Benefits	
Have disproportionate benefit to severely disadvantaged communities	++
Sustainability Benefits	
Provide a long-term solution in place of a short-term one	+
D3 Monetized Benefits Analysis	Not applicable
D4 Flood Damage Reduction Benefits	
Flood Damage Reduction Benefits	
Avoided residential and road damage	$1,904,588
Total Monetizable Benefits	$1,904,588
Benefit to Cost Ratio	0.55

Notes:

* Direction and magnitude of effect on net benefits:

+ = Likely to increase net benefits relative to quantified estimates.
++ = Likely to increase net benefits significantly.
– = Likely to decrease benefits.
– – = Likely to decrease net benefits significantly.
U = Uncertain, could be + or –.

8.5.2 The "Without Project" Baseline

As described in detail in Attachment 7, flooding within the City has been documented along the approximately quarter-mile stretch of Sycamore Road between Comanche Drive, Walnut Drive, and Meyer Street. At the low point in the area, this portion of Sycamore Road receives flow not only from local drainages but also receives flow from a larger region of almost 277 acres of commercial and residential properties when upstream facilities are overwhelmed. In addition, the City is topographically flat and can experience rainfall of up to 1.8 inches per day (as occurred in December 2010), resulting in significant flooding for long durations as the water cannot efficiently drain.

Runoff from the northern side of Sycamore Road, a mobile home park, and a housing tract are conveyed to undersized detention ponds which can fill up quickly and then are no longer able to receive stormwater from the public roads, even on annual events. While there are localized mounds of soil and a concrete masonry unit (CMU) privacy fence that impedes some flows, there is no formal flood protection berm to the north of Sycamore Road to protect mobile home properties from flood depths that can potentially damage crawl spaces, storage, and outdoor areas as a result of local flooding. The flooding of the crawl space can result in structural damage to the mobile home foundation, a sagging floor due to rotting wood, mold development with potential harmful spore allergens, and damage to personal property stored in the crawl space as well as damage to low-clearance vehicles. Each of these issues can lead to expensive repair and renovation costs that would be borne by mobile home owners who are typically low income residents.

Flooding of up to two feet occurs annually at the Meyer Street/Sycamore Road intersection requiring closure of Meyer Street including the north lane of Sycamore Road. Photographs and estimated flooding extents from a storm as recent as March 8, 2013 are provided in **Attachment 7**.

During some larger storm events, as occurred in December 2010, the City of Arvin has had to rent 3-inch and 4-inch trash pumps (in addition to available City owned portable pumps) to pump stormwater from the local detention basins across Sycamore Road to the undeveloped parcel to the south. Pumping has been known to last in excess of four days to reduce the inundation in and along the roadway. From December 18 to December 20 2010, daily rainfall totals ranged from 0.92 inches/day to 1.8 inches per day with estimated daily return intervals that range from less than 2 year up to greater than 10 year. The 3 day total rainfall of 3.8 inches is estimated to be greater than a 100 year 3-day rainfall event. Specific rainfall and return interval details can be found in Attachment 7.

In order to obtain flood data for the "without project" baseline, a technical analysis, described in detail in Attachment 7, was conducted by Provost and Pritchard Consulting Group using available information such as storm drainage master plans and photos provided by the City as well as collecting field global positioning system (GPS) elevation data in the project area. In addition, Helt Engineering a consultant to the City has prepared preliminary hydrologic and hydraulic calculations in preparation for design of this project. As described in Attachment 7, photographs from actual flood events, elevation data from the GPS survey, and other

information were used to estimate the areas of inundation and flood water depths for the storm events as summarized in **Table 8.5-2** below. The Flood Rapid Assessment Model (FRAM) was used to estimate the Expected Event Damage as described in D4 below.

Table 8.5-2: Flood Events Analyzed

Flood Event	Estimated Flood Depth above Ground Level	Estimated Mobile Homes Inundated	Estimated Miles of Major Roads Inundated	Estimated Duration of Inundation
1-year	0.2	0	0.22	2 days
50-year	0.92	19	0.27	4 days
100-year	1	29	0.27	4+ days

8.5.3 Cost-Effectiveness Analysis (Section D1)

This analysis was not performed as the total project cost exceeds the $1 million threshold.

8.5.4 Non-Monetized Benefits Analysis (Section D2)

As summarized above, non-monetized benefits for the Sycamore Road Storm Drainage Project include providing promoting social health and safety and providing a long-term solution as opposed to a short-term solution. Another benefit of reducing street flooding is protection of the road infrastructure and extending the longevity of the pavement and road base. Frequent saturation of roads can result in more rapid deterioration of the asphalt and underlying road base which can be costly to the City and its citizens.

Table 8.1-1 (PSP Table 12) shows the applicable non-monetized benefits and the narrative that follows describes these benefits in detail. These benefits have also been described in Attachments 3 and 7.

Table 8.5-3: (PSP Table 12)- Non-Monetized Benefits Checklist

No.	Question	Enter "Yes", "No" or "Neg"
	Community/Social Benefits **Will the proposal**	
1	**Provide education or technology benefits?**	No
	Examples are not limited to, but may include: - Include educational features that should result in water supply, water quality, or flood damage reduction benefits? - Develop, test, or document a new technology for water supply, water quality, or flood damage reduction management? - Provide some other education or technological benefit?	

No.	Question	Enter "Yes", "No" or "Neg"
2	**Provide social recreation or access benefits?**	No
	Examples are not limited to, but may include: - Provide new or improved outdoor recreation opportunities? - Provide more access to open space? - Provide some other recreation or public access benefit?	
3	**Help avoid, reduce or resolve various public water resources conflicts?**	No
	Examples are not limited to, but may include: - Provide more opportunities for public involvement in water management? - Help avoid or resolve an existing conflict as evidenced by recurring fines or litigation? - Help meet an existing state mandate (e.g., water quality, water conservation, flood control)?	
4	**Promote social health and safety?**	Yes
	Examples are not limited to, but may include: - Increase urban water supply reliability for fire-fighting and critical services following seismic events? - Reduce risk to life from dam failure or flooding? - Reduce exposure to water-related hazards?	
5	**Have other social benefits?**	Yes
	Examples are not limited to, but may include: - Redress or increase inequitable distribution of environmental burdens? - Have disproportionate beneficial or adverse effects on disadvantaged communities, Native Americans, or other distinct cultural groups?	
	Environmental Stewardship Benefits: **Will the proposal**	
6	**Benefit wildlife or habitat in ways that were not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Cause an increase in the amount or quality of terrestrial, aquatic, riparian or wetland habitat?	

No.	Question	Enter "Yes", "No" or "Neg"
	- Contribute to an existing biological opinion or recovery plan for a listed special status species? - Preserve or restore designated critical habitat of a listed species? - Enhance wildlife protection or habitat?	
7	**Improve water quality in ways that were not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Cause an improvement in water quality in an impaired water body or sensitive habitat? - Prevent water quality degradation? - Cause some other improvement in water quality?	
8	**Reduce net emissions in ways that were not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Reduce net production of greenhouse gasses? - Reduce net emissions of other harmful chemicals into the air or water?	
9	**Provide other environmental stewardship benefits, other than those claimed in Sections D1, D3, or D4?**	No
	Sustainability Benefits: **Will the proposal**	
10	**Improve the overall, long-term management of California groundwater resources?**	No
	Examples are not limited to, but may include: - Reduce extraction of non-renewable groundwater? - Promote aquifer storage or recharge?	
11	**Reduce demand for net diversions for the regions from the Delta?**	No
12	**Provide a long-term solution in place of a short-term one?**	Yes
13	**Promote energy savings or replace fossil fuel based energy sources with renewable energy and resources?**	No
	Examples are not limited to, but may include: - Reduce net energy use on a permanent basis?	

No.	Question	Enter "Yes", "No" or "Neg"
	- Increase renewable energy production? - Include new buildings or modify buildings to include certified LEED features? - Provide a net increase in recycling or reuse of materials? - Replace unsustainable land or water management practices with recognized sustainable practices?	
14	**Improve water supply reliability in ways not quantified in Attachment 7?**	No
	Examples are not limited to, but may include: - Provide a more flexible mix of water sources? - Reduce likelihood of catastrophic supply outages? - Reduce supply uncertainty? - Reduce supply variability?	
15	**Other (If the above listed categories do not apply, provide non-monetized benefit description)?**	No

Increased Public Safety

One of the primary secondary benefits of this project will be increased public safety. Flooding in the project location results in closure of roadways and intersections. A large number of students in this severely disadvantaged community walk to or drive through the flooded area to El Camino Elementary School that is located to the south of Sycamore Road at El Camino Real. When intersections are closed due to flooding, the student's normal path of egress at a crosswalk at Sycamore Road and Meyer Street cannot be used, and children must cross this major road at points that are not designated for pedestrians. In addition, the children are crossing Sycamore Road during periods of low visibility, further increasing the danger of injury. Eliminating the flood hazard during a broad range of flood events provides a significant public safety benefit to the approximately 880 local pre-kindergarten through sixth grade school children at El Camino Real Elementary School.

Increased local property values

Local property values are anticipated to increase as a result of the reduced flood risk, resulting from the Sycamore Road Storm Drainage Project. Once flooding problems are solved, public officials and local real estate agents will be able to promote the improved access and infrastructure as well as public safety improvements to potential home buyers and renters. The parcels that flooded from the 2010 event should increase in property value as the lots will now be developable.

Have disproportionate benefit to severely disadvantaged communities

The City is a Central Valley community with a median household income (MHI) of 48% of the statewide MHI which is not only below 80% of the statewide MHI which characterizes disadvantaged communities but is also well below the 60% MHI that characterizes "severely disadvantaged communities". The City of Arvin requires grant funding to provide the capital resources to implement a project of this magnitude which will prevent flooding in a mobile home park which typically provides housing to low-income residents. As estimated earlier, a 50-year event could inundate 19 mobile homes while a 100-year could inundate 29 homes. Using the estimated 4.36 persons per household from the 2007-2011 American Community Survey of the US Census, the severely disadvantaged population that may be impacted by flooding ranges from 83 people for a 50-year event up to 126 people for a 100-year event. Therefore this project would significantly benefit a severely disadvantaged community.

Provide a long-term solution in place of a short-term one

The City has proposed this regional project in order to meet the needs of both the community in the immediate area of Sycamore Road but also to benefit upstream areas within the 277 acre drainage by sizing and locating the pipeline and retention basin such that it provides regional long-term benefit. A smaller project could provide local, near-term benefit and act as a "band-aid" for existing residences and businesses, but this larger project provides broader benefits into the future.

Protection of existing road infrastructure

Extended saturation of road ways from standing water as occurs in flood events will increase the rate of deterioration of the asphalt and road base. Reducing the flooding, especially from frequent storm events, will extend the longevity of the roads and reduce the costs to the City and its citizens. Based on the inundation areas, estimates of miles of flooded roads are provided in each flood scenario to be used in the FRAM model for estimating damages in Attachment 8.

8.5.5 Monetized Benefits Analysis (Section D3)

As there are no quantified benefits that are not associated with flood damage reduction, this section is not applicable.

8.5.6 Flood Damage Reduction Benefits Analysis (Section D4)

Flood benefits include avoided flood damage to residential mobile home properties in Arvin. This includes primarily content damages, external damages to gardens/outdoor areas, and cleanup costs. Structural damage is limited because the finished floor elevation of the mobile homes is two feet above ground surface and flood depths are often about 1 feet for several days. Avoided flood damage has been monetized using the Flood Rapid Assessment Model (FRAM); input and output files are provided as Appendix 8-1. As stated in the FRAM User Manual, the total project capital cost being evaluated, a value of $3,857,523 was entered into the model. The present value was obtained from the project cost in the Proposal Solicitation Package (PSP) Table 7 as presented in Attachment 4. In order to obtain the estimated residential damages from the FRAM model, the project was evaluated at a 6% discount rate with a project life of 50 years.

Other input data included in the FRAM model was obtained through the technical analysis, described in Attachment 7 that was performed by Provost and Pritchard using GPS elevation data, photographs from actual flood events, and other technical analyses. A contour map from GPS data was created, inundation elevations estimated, and elevations were overlaid on an aerial photograph as found Attachment 7 from which the number of residences within elevation contours could be counted. Based on observation, residences that were to be inundated were in the mobile home category which was used as the input for the FRAM. The construction costs for the mobile homes on which damages were estimated was the default cost in FRAM. As these are mostly older mobile homes built in the 1960s, a conservative ratio of 5% was selected for depreciation value to replacement input (i.e. there is very limited residual value left in the mobile homes). Those inputs include the results of a modeling analysis to determine flood damages for a 1-, 50-, and 100-year flood with and without the project for existing residential properties, both for structural and contents damages.

The FRAM provided output of actual residential damage values that were entered PSP Table 17 that account for some uncertainties such as warning time and flood experience. The “actual” estimated damages for the 1-, 50-, and 100-year storm events were estimated by FRAM to be $27,500, $247,500 and $360,000 respectively. The damage estimated by FRAM is comprised of external damage to property and clean up costs as well as damage to Sycamore Road, a major road. FRAM output is found in Appendix 8-1.

After obtaining these FRAM residential estimated damages that would occur from a “without project” scenario, PSP Table 17 was used to calculate Expected Annual Damages for the “with project” and “without project” scenarios. This table used the probability of flooding due to lack of facility, the expected event damages in each case, and the interval probabilities to arrive at the expected annual damages of $137,837 per year for the “without project” case, and $16,988 per year for the “with project” case. Some limited damage is estimated to occur in the 50-year and

100-year events with the project since local drainage projects are rarely sized for events greater than a 25-year event.

With a 50-year project life and a 6% discount rate considered, the total present value of the project benefits is presented in PSP Table 18 to be $1,904,588. With a total present value of the project estimated to be $3,443,882 (PSP Table 19), the costs exceed monetized benefits of the project. However, as described in Section D2, there are significant qualitative benefits of the project including public safety in a severely disadvantaged community as well as providing assistance to a community that could not otherwise afford to construct this project.

8.5.7 Avoided Physical Damage

FRAM Structural Damages, Content Damages, External Costs, and Cleanup Cost Estimates

To arrive at the estimated event damages in the FRAM model above, the model took into account separate residential damages such as structural damages, content damages, external/outdoor damages, and cleanup costs to arrive at the total residential damages for the particular storm events. These components of the total damages can be seen in **Table 8.5-4** below:

Table 8.5-4: FRAM Estimated Actual Damages

Storm Event	Estimated Road Damages	Estimated Residential Content/External Damages and Cleanup Costs	Estimated Direct Costs (as percentage of other damages)	Total Estimated Damages
1-year	$22,000	$0	$5,500	$27,5000
50-year	$27,000	$171,000	$49,500	$247,500
100-year	$27,000	$261,000	$72,000	$360,000

Table *8.5-5* (PSP Table 17) that follows provides the Calculation of Expected Annual Damage Benefits based on the 3 hydrologic events analyzed and the damages with and without the project for those events. The expected annual damages without the project is estimated to be $137,837 while there is expected $16,988 damage with the project since 50-year and 100-year flows are not typically conveyed in local drainage projects.

Table 8.5-6 (PSP Table 18) that follows provides the Present Value of Expected Annual Damage Benefits which is based on a present value coefficient of 15.76 for a 6% discount rate over the 50-year analysis period. The present value of the future benefits is estimated to be $1,904,588.

Table 8.5-5: Calculation of Expected Annual Damage Benefits (PSP Table 17)

Table 17 – Calculation of Expected Annual Damage - Sycamore Road Flood Reduction Project											
Hydrologic Event	Event Exceedance Probability	Event Damage if Flood Structures Fail/Are Not	Probability Structural Failure		Expected Event Damage		Interval Probability	Average Damage in Interval		Average Damage in Interval times Interval Probability	
			Without Project	With Project	Without Project	With Project		Without Project	With Project	Without Project	With Project
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(i)	(j)	(k)	(l)	(m)
					(c) x (d)	(c) x (e)	from (b)	from (f)	from (g)	(i) x (j)	(i) x (k)
1-year	1.00	$22,000	1	0	$27,500	$0					
50-year	0.02	$198,000	1	0	$247,600	$33,750	0.98	$137,550	$16,875	$134,799	$16,538
100-year	0.01	$288,000	1	0	$360,000	$56,250	0.01	$303,800	$45,000	$3,038	$450
								Expected Annual Damages, Without and With Project		$137,837	$16,988
Expected Damage Estimates are derived from FRAM Model Results found in Appendix 8-1											

Table 8.5-6: Present Value of Expected Annual Damage Benefits (PSP Table 18)

Table 18 – Present Value of Expected Annual Damage Reduction Benefits Project: Sycamore Road Flood Reduction Project			
(a)	Expected Annual Damage Without Project [1]		**$137,837**
(b)	Expected Annual Damage With Project [1]		**$16,988**
(c)	Expected Annual Benefit	(a) – (b)	**$120,850**
(d)	Present Value Coefficient [2]		**15.76**
(e)	**Present Value of Future Benefits Transfer to Table 20, column (e).**	**(c) x (d)**	**$1,904,588**

(1) This program assumes no land use changes in the floodplain. So, EAD will be constant over analysis period.
(2) 6% discount rate; 50-year analysis period (could vary depending upon lifecycle of project).

8.5.8 D5: Project Benefits and Cost Summary

Project costs are documented in detail in the Budget, Attachment 4 of this Prop 84 Grant Proposal. Costs include direct project administration costs, land purchase easement, planning/design/engineering/environmental documentation, construction/implementation, environmental compliance/mitigation/enhancement, construction administration, others costs, and construction/implementation contingency. The grand total of these separate task costs for project development is $3,857,523. These costs were distributed based on a 3-year schedule for design, permitting, environmental documentation, and construction whereby 5% of the cost is incurred during 2013, 75% of the cost in 2014 and 20% of the cost occurs in 2014. Operations and Maintenance for this project are expected to be $3,000/year each for activities such as inspections and cleaning of sediments from the storm drain. The present value of discounted costs, including operations and maintenance, is $3,443,882, as presented in **Table 8.5-7** (PSP Table 19) that follows.

Table 8.5-7: Annual Costs of the Project (PSP Table 19)

Table 19 – Annual Costs of Project
(All costs should be in 2012 Dollars)
Project: Sycamore Road Flood Reduction Project

	Initial Costs Grand Total Cost from Table 7 (row (i), column	Adjusted Grant Total Cost[1]	Annual Costs [2]						Discounting Calculations	
			Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +...+ (g)	Discount Factor	Discounted Project Costs (h) x (i)
Year	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
2013									1.000	
2014	$ 192,876	$ 192,876						$ 192,876	0.943	$ 181,959
2015	$ 2,893,142	$ 2,893,142			0			$2,893,142	0.890	$ 2,574,886
2016	$ 771,505	$ 771,505			0			$ 771,505	0.840	$ 647,770
2017					3000			$ 3,000	0.792	$ 2,376
2018					3000			$ 3,000	0.747	$ 2,242
2019					3000			$ 3,000	0.705	$ 2,115
2020					3000			$ 3,000	0.665	$ 1,995
2021					3000			$ 3,000	0.627	$ 1,882
2022					3000			$ 3,000	0.592	$ 1,776
2023					3000			$ 3,000	0.558	$ 1,675
2024					3000			$ 3,000	0.527	$ 1,580
2025					3000			$ 3,000	0.497	$ 1,491
2026					3000			$ 3,000	0.469	$ 1,407
2027					3000			$ 3,000	0.442	$ 1,327
2028					3000			$ 3,000	0.417	$ 1,252
2029					3000			$ 3,000	0.394	$ 1,181
2030					3000			$ 3,000	0.371	$ 1,114
2031					3000			$ 3,000	0.350	$ 1,051
2032					3000			$ 3,000	0.331	$ 992
2033					3000			$ 3,000	0.312	$ 935
2034					3000			$ 3,000	0.294	$ 882
2035					3000			$ 3,000	0.278	$ 833
2036					3000			$ 3,000	0.262	$ 785
2037					3000			$ 3,000	0.247	$ 741
2038					3000			$ 3,000	0.233	$ 699
2039					3000			$ 3,000	0.220	$ 659
2040					3000			$ 3,000	0.207	$ 622
2041					3000			$ 3,000	0.196	$ 587
2042					3000			$ 3,000	0.185	$ 554
2043					3000			$ 3,000	0.174	$ 522
2044					3000			$ 3,000	0.164	$ 493
2045					3000			$ 3,000	0.155	$ 465
2046					3000			$ 3,000	0.146	$ 439
2047					3000			$ 3,000	0.138	$ 414
2048					3000			$ 3,000	0.130	$ 390
2049					3000			$ 3,000	0.123	$ 368
2050					3000			$ 3,000	0.116	$ 347
2051					3000			$ 3,000	0.109	$ 328
2052					3000			$ 3,000	0.103	$ 309
2053					3000			$ 3,000	0.097	$ 292
2054					3000			$ 3,000	0.092	$ 275
2055					3000			$ 3,000	0.087	$ 260
2056					3000			$ 3,000	0.082	$ 245
2057					3000			$ 3,000	0.077	$ 231
2058					3000			$ 3,000	0.073	$ 218
2059					3000			$ 3,000	0.069	$ 206
2060					3000			$ 3,000	0.065	$ 194
2061					3000			$ 3,000	0.061	$ 183
2062					3000			$ 3,000	0.058	$ 173
2063					3000			$ 3,000	0.054	$ 163
									Total Present Value of Discounted Costs (Sum of column (j))	$ 3,443,882
									Transfer to Table 20, column (c), Proposal Benefits and Costs Summaries	

Comments:

(1) If any, based on opportunity costs, sunk costs and associated costs
(2) The incremental change in O&M costs attributable to the project

With the total present value of benefits equaling $1,904,588 as derived from **Table 8.5-6** (PSP Table 18), there is a benefit cost ratio of 0.55. Although the monetized benefits that can be obtained from implementing this project do not exceed the estimated cost, other qualitative benefits such as public safety benefits in a severely disadvantaged community should be given high consideration.

8.5.9 References

AECOM, 2009, Storm Drainage Master Plan Update

City of Arvin. December 2010 and March 8, 2013 flood event photos.

Department of Water Resources, Division of Flood Management, November 2008, Flood Rapid Assessment Model Development and User Manual.

Helt Engineering Preliminary Engineering Hydraulic Analyses and Drainage Plans, March 2013

Provost & Pritchard Consulting Group, Sycamore Road Flood Analysis, March 2013

8.6 Proposal Benefits and Costs Summary

The Proposal Benefits and Cost Summary are presented in **Table 8.6-1** (PSP Table 20).

Table 8.6-1: Proposal Benefits and Costs Summary

Table 20 – Proposal Benefits and Costs Summary Proposal Title: Kern IRWM Group Implementation Grant Proposal							
Project	Project Proponent	Total Present Value Project Costs (1)	Total Present Value Project Benefits			From Section D1 – Cost-Effectiveness Analysis, Cost Savings	From Section D2 – Briefly describe the main Non-monetized benefits
			From Section D3 – Monetized (2)	From Section D4 – Flood Damage Reduction (3)	Total		
(a)	(b)	(c)	(d)	(e)	(f) = (d) + (e)	(g)	(h)
Urban Bakersfield Water Use Efficiency Project	KCWA Improvement District No. 4	$794,114	$1,281,796	$0	$1,281,796		Increased Education, Meets Mandates for Water Conservation, Improved Water Supply Reliability
Tehachapi Regional Water Use Efficiency Project	Tehachapi-Cummings County Water District	$687,375	$856,199	$0	$856,199		Increased Education, Meets Mandates for Water Conservation, Improved Water Supply Reliability, Benefits DAC
Snyder Well Intertie Pipeline Project	City of Tehachapi	629,042	$515,962	$0	$515,962		Maximize Use of Lesser Quality Water, Improve Water Supply Reliability, Improve Water Quality for DAC
Kern Water Bank Recharge and Recovery Project	Kern Water Bank Authority	$7,839,349	$13,605,296	$0	$13,605,296		Reduce Water Resources Conflicts, Benefit Wildlife, Improved Water Supply Reliability, GW Lift Reduction
Sycamore Road Flood Reduction Project	City of Arvin	$3,443,882		$1,904,588	$1,904,588		Promote Social Health and Safety, Increase Property Values, Benefits DAC, Long Term Solution

(1) From Table 19, or RWMG method
(2) From Table 15 or RWMG method
(3) From Table 18 or RWMG method